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Record of Work of Electron Physics Section 1949 - 1985

September 1986

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RECORD OF WORK
OF
ELECTRON PHYSICS SECTION
1949 - 1986

ERB-993
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TABLE OF CONTENTS

	Page
ELECTRON PHYSICS SECTION	v
SECTION DE PHYSIQUE ÉLECTRONIQUE	vi
ELECTRON PHYSICS TECHNICAL STAFF AND SECRETARIES: 1949-1982	vii
PART 1: PUBLICATIONS IN JOURNALS	1
PART 2: BOOKS AND BOOK CHAPTERS	28
PART 3: PRESENTED PAPERS	29
PART 4: COURSES PRESENTED	58
PART 5: DIVISIONAL REPORTS	59
PART 6: PATENTS	60
PART 7: STAFF SERVING ON OUTSIDE ORGANIZATIONS	62
PART 8: POSTDOCTORATE FELLOWS - RESEARCH ASSOCIATES	66
PART 9: GUEST WORKERS	68
PART 10: INTERACTIONS WITH CANADIAN INDUSTRY	70
PART 11: LIQUID HELIUM	71
PART 12: PRESENT STAFF, OCTOBER 1985	72

ELECTRON PHYSICS SECTION

Prior to 1963, the Electron Physics Section was part of the Microwave Section of the Division of Radio and Electrical Engineering. Since the work of the Section forms a continuous pattern spanning both administrative structures, it has been collected here starting at the year 1949. Near the end of 1985 the staff of the Electron Physics Section was transferred from the Division of Electrical Engineering to the new Division of Microstructural Sciences, thereby forming one of the two main building blocks of the latter.

In the pages which follow will be found a factual chronological record of our work spanning 36 years. As such, the record represents a substantial fraction of the life's work of many individuals. This collection is probably the only place where this work is arrayed as an entity, but as a record of effort it has one serious deficiency. The names of the scientific staff are adequately represented by their published papers and oral presentations, but the names of their technical assistants and secretaries are much less adequately represented, appearing frequently in the form of acknowledgements only. We would like therefore to dedicate this compilation to our support staff whose names we list herein as a token of our thanks for their efforts over the years.

Professional Staff
of the Electrical Physics Section

SECTION DE PHYSIQUE ÉLECTRONIQUE

Avant 1963, la Section de physique électronique faisait partie de la Section micro-ondes de la Division de radio et génie électrique. Étant donné que les travaux de la section forment un ensemble continu recouvrant les deux structures administratives, nous avons rassemblé ici les rapports recueillis depuis 1949. Vers la fin de 1985 le personnel de la Section physique électronique a été transféré de la Division de génie électrique à la nouvelle Division de Sciences des microstructures, constituant ainsi un des deux blocs principaux de cette dernière.

Les pages qui suivent contiennent un bilan factuel chronologique de notre travail au cours des 36 dernières années. Un tel bilan représente donc une fraction non négligeable de l'activité professionnelle de nombreuses personnes. Ce recueil est probablement le seul endroit où ce travail est présenté comme une entité mais, en tant que témoin des efforts, il présente un défaut de taille. Si les chercheurs sont representés adéquatement par leur rapports publiés et leurs présentations orales, il n'en va pas de même pour leurs assistants techniques et leurs secrétaires dont les noms n'apparaissent souvent que dans les formules de remerciements. Nous aimerions donc dédier ce recueil à notre personnel de soutien, dont les noms apparaissent ci-après, en témoignage de notre reconnaissance pour les efforts qu'ils ont déployés au cours de toutes ces années.

Personnel professionnel
de la Section de physique
électronique

ELECTRON PHYSICS TECHNICAL STAFF AND SECRETARIES: 1949-1985

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RECORD OF WORK OF ELECTRON PHYSICS SECTION
Electrical Engineering Division
National Research Council of Canada
1949 - 1985

PART 1: PUBLICATIONS IN JOURNALS

1. Henderson, W.J. and Redhead, P.A. The electron cyclotron. Nucleonics, 5: 60-67; 1949.

2. Redhead, P.A., LeCaine, H. and Henderson, W.J. The electron cyclotron. Can. J. Res. 28: 73-91; 1950.

3. Redhead, P.A. The effect of ion bombardment on the emission from oxide coated cathodes. Can. J. Phys. 29: 362-369; 1951.

4. Redhead, P.A. A linear radio-frequency mass spectrometer. Can. J. Phys. 30: 1-13; 1952.

*5. Hobson, J.P. and Nierenberg, W.A. Statistics of a two-dimensional, hexagonal net. Phys. Rev. 89: 662; 1953.

6. Redhead, P.A. and Crowell, C.R. Analysis of the linear RF mass spectrometer. J. Appl. Phys. 24: 331-337; 1953.

*7. Hobson, J.P., Hubbs, J.C., Nierenberg, W.A. and Silsbee, H.B. Spin, magnetic moment and hyperfine structure of Rb^{81}. Phys. Rev. 96: 1450; 1954.

8. Redhead, P.A. and McNarry, L.R. An ionization manometer and control unit for extremely low pressures. Can. J. Phys. 32: 267-274; 1954.

9. Redhead, P.A. and Webb, E.L.R. Transistors and the electrical industry. Engineering J. June 1954.

10. Redhead, P.A. as a member of the 1953 Annual Review Committee of I.R.E. Radio progress during 1953 - Electron tubes. Proc. IRE, 42(4): 720-725; 1954.

11. Crowell, C.R. Theoretical basis for measuring the saturation emission of highly emitting cathodes under space-charge-limited conditions. J. Appl. Phys. 26: 1353-1356; 1955.

12. Redhead, P.A. Microwave detection in a thermionic diode. Proc. IRE, 43: 995-1000; 1955.

13. Armstrong, H.L. On open circuit transient effects in point contact rectifiers. J. Appl. Phys., Letter to the editor, 27: 420, 1956.

*Paper published while author member of Electron Physics Section, but work done elsewhere.

*14. Armstrong, H.L. A matrix representation of the geometrically tapered chain of four-terminal networks. IRE Trans. Circuit Theory, CT-3: 136-137; 1956.

*15. Armstrong, H.L. A treatment of cascaded active four-terminal networks with application to transistor circuits. IRE Trans. Circuit Theory, CT-3: 138-140; 1956.

16. Crowell, C.R. Effect of the cathode work function on the space-charge-limited characteristics of plane diodes. J. Appl. Phys. 27: 93; 1956.

*17. Hobson, J.P., Hubbs, J.C., Nierenberg, W.A., Silsbee, H.B. and Sunderland, R.J. Spins of rubidium isotopes of masses 81, 82, 83, 84. Phys. Rev. 104: 101-106; 1956.

18. Hobson, J.P. The reflection of slow electrons from tantalum and copper. Can. J. Phys. 34: 1089-1096; 1956.

19. Redhead, P.A. Periodic fluctuations in oxide-cathode diodes. Can. J. Phys. 34: 1077-1079; 1956.

20. Armstrong, H.L. On a space-time representation of non-relativistic wave mechanics. Am. J. Phys. 25: 195-199; 1957.

21. Armstrong, H.L. A theory of voltage breakdown of cylindrical P-N junctions, with applications. IRE Trans. Electron Devices, 4: 15-16; 1957.

22. Armstrong, H.L. On the switching transient in the forward conduction of semiconductor diodes. IRE Trans. 4: 111-113; 1957.

23. Armstrong, H.L. On the tail in the transient behaviour of point-contact diodes. Proc. IRE, 45: 696-697; 1957.

24. Armstrong, H.L. Comparator method for optical lifetime measurements on semiconductors. Rev. Sci. Instrum. 28: 202; 1957.

25. Armstrong, H.L. A simple rectangular pulse generator. Can. J. Phys. 35: 1250-1252; 1957.

26. Armstrong, H.L. On finding an orthonormal basis for representing transients. IRE Trans. CT-4: 286-287; 1957.

*27. Kornelsen, E.V., Vessot, R.F.C. and Woonton, G.A. Current and velocity fluctuations at the anode of an electron gun. J. Appl. Phys. 28: 1213-1214; 1957.

28. Redhead, P.A. A simple ionization gauge control circuit with overload protection. Can. J. Phys. 35: 237-238; 1957.

---

* Paper published while author member of Electron Physics Section, but work done elsewhere.

29. Redhead, P.A. and McNarry, L.R. High sensitivity, simplicity are features of new omegatron. Can. Electronics Eng. 1: 28-31; 1957.

30. Hobson, J.P. and Redhead, P.A. Operation of an inverted magnetron gauge in the pressure range 10^{-3} to 10^{-12} mm Hg. Can. J. Phys. 36: 271-288; 1958.

31. McNarry, L.R. Oscillations in the omegatron. Can. J. Phys. 36: 1710-1713; 1958.

32. Redhead, P.A. The Townsend discharge in a coaxial diode with axial magnetic field. Can. J. Phys. 36: 255-270; 1958.

33. Redhead, P.A. The production and measurement of ultrahigh vacuum (10^{-8} to 10^{-13} mm Hg). 5th Nat. Symp. on Vac. Technol. Trans., Pergamon Press, 1958.

*34. Szabo, A. Thermal velocity effects in magnetically confined beams. IRE Trans. Electron Devices, 5: 183-185; 1958.

*35. Armstrong, R.A. and Crowell, C.R. Temperature dependence of the work function of silver, sodium and potassium. Phys. Rev. 114: 1500-1506; 1959.

36. Hobson, J.P. First absorbed layer of helium at 4.2°K. Can. J. Phys. 37: 300-312; 1959.

37. Hobson, J.P. First adsorbed layer of nitrogen on Pyrex at 77.4°K. Can. J. Phys. 37: 1105-1113; 1959.

38. Kornelsen, E.V. and Weeks, J.O. High-temperature laboratory vacuum furnace. Rev. Sci. Instrum. 30: 290-291, 1959.

39. Redhead, P.A. The magnetron gauge: A cold-cathode vacuum gauge. Can. J. Phys. 37: 1260-1273; 1959.

40. Redhead, P.A. The desorption spectrometer as an analytic tool in ultrahigh vacuum investigations. 6th Nat. Symp. on Vac. Technol. Trans. 6: 12-15; 1959. (Pergamon Press)

41. Szabo, A. Relaxation time and multiple pumping effects in masers. Can. J. Phys. 37: 1557-1561; 1959.

42. Armstrong, R.A. and Szabo, A. Relaxation in ruby. Can. J. Phys. 38: 1304-1317; 1960.

*43. Kendall, B.R.F. New method of sample interchange in a solid-source mass spectrometer. J. Sci. Instrum. 37: 130-131; 1960.

*44. Kendall, B.R.F. Isotopic composition of potassium. Nature, 186: 225-226; 1960.

* Paper published while author member of Electron Physics Section, but work done elsewhere.

45. Hobson, J.P. and Redhead, P.A. Factors limiting ultimate pressure in ultrahigh vacuum systems. Adv. Vac. Sci. Technol. 1: 384-388; 1960.

46. Kornelsen, E.V. A small ionic pump employing metal evaporation. Trans. American Vacuum Society, 7: 29-34; 1960 (Pergamon Press).

47. Redhead, P.A. Modulated Bayard-Alpert gauge. Rev. Sci. Instrum. 31: 343-344; 1960.

48. Redhead, P.A. Pressure measurements at ultrahigh vacuum (10^{-8} to 10^{-14} mm Hg). Adv. Vac. Sci. Technol. 1: 410-413; 1960.

49. Redhead, P.A. Errors in the measurement of pressure with ionization gauges. Trans. American Vacuum Society Symp. 7: 108-111; 1960 (Pergamon Press).

50. Hobson, J.P. and Armstrong, R.A. A study of physical adsorption with ultra-high-vacuum techniques. Report on 21st Annual Conf. on Phys. Electronics, Massachusette Institute of Technology, pp. 236-241; 1961.

51. Hobson, J.P. Physical adsorption in ultrahigh vacuum systems. Trans. American Vacuum Society Symp. 8: 146-150; 1961.

52. Hobson, J.P. Physical absorption of nitrogen on Pyrex at very low pressures. J. Chem. Phys. 34: 1850-1851; 1961.

53. Hobson, J.P. The pumping of nitrogen by a Bayard-Alpert ionization gauge in an ultra-high-vacuum system. Vacuum 11: 16-25; 1961.

54. Hobson, J.P. Desorption of adsorbed gas and re-emission of gas previously pumped by ionic pumping. Trans. American Vacuum Society Symp. 8: 26-30; 1961.

55. Hobson, J.P. and Khan, I. Specular reflection in the diffraction of slow electrons near normal incidence. Phys. Rev. Lett. 6: 715; 1961.

56. Hobson, J.P. and Khan, I. Specular reflection in the diffraction of slow electrons at near normal incidence. Phys. Rev. 123: 1241-1242; 1961.

57. Kendall, B.R.F. A method of increasing the resolving power of mass spectrometers and other analytic instruments. Rev. Sci. Instrum. 32: 758-760; 1961.

58. Kornelsen, E.V. The desorption of ionically trapped argon from tungsten. Trans. Nat. Symp. on Vac. Technol. 8: 281-286; 1961.

59. Redhead, P.A. Chemisorption on polycrystalline tungsten; Part I - carbon monoxide. Trans. Faraday Soc. 57: 641-656; 1961.

60. Redhead, P.A. and Kornelsen, E.V. Some recent developments in ultrahigh vacuum technology. Vakuum-Technik, 10: 31; 1961.

61. Szabo, A. and Dimock, E.L. Low temperature optical window. Rev. Sci. Instrum. 32: 1256; 1961.

62. Kendall, B.R.F. A resolving power multiplier for mass spectrometers. Rev. Sci. Instrum. 33: 30-37; 1962.

63. Kendall, B.R.F. Automatic data processing for a sensitive time-of-flight mass spectrometer. J. Sci. Instrum. 39: 267-272; 1962.

64. Redhead, P.A. Thermal desorption of gases. Vacuum, 12: 203-211; 1962.

65. Redhead, P.A. Variations in the "X-ray limit" of hot-cathode gauges. Vacuum, 12: 267; 1962.

66. Redhead, P.A. and Steinherz, H.A. Ultrahigh vacuum. Scientific American, 206(3): 78-88, 90; 1962.

67. Redhead, P.A. Chemisorption on metals under ultrahigh vacuum conditions. Proc. Symp. on Electron and Vacuum Phys. p. 89, Hungary, September 1962 (Akadémai Kiado, Budapest, 1963).

68. Redhead, P.A., Kornelsen, E.V. and Hobson, J.P. Ultrahigh vacuum in small glass systems. Can. J. Phys. 40: 1814-1836; 1962.

69. Robins, J.L. Replacement of chemisorbed gases on tungsten. Trans. 9th Nat. Vac. Symp. 9: 510-514; 1962.

70. Szabo, A. Magnetic field dependence of the Al^{27} polarization time in ruby. J. Chem. Phys. 36: 562-563; 1962.

71. Szabo, A. and Lipsett, F.R. Side emission from ruby laser rods. Proc. IRE, 50: 1690; 1962.

72. Hayward, W.H., Jepsen, R.L. and Redhead, P.A. Reverse X-ray currents in Bayard-Alpert ionization gauges. Trans. American Vacuum Society, 10: 228-233; 1963.

73. Hobson, J.P. and Edmonds, T. Reversible adsorption of helium at liquid nitrogen temperatures in an ionization gauge. Can. J. Phys. 41, 827-828; 1963.

74. Hobson, J.P., Edmonds, T. and Verreault, R. Thermal transpiration in helium in the pressure range 10^{-8} to 20 Torr. Can. J. Phys. 41: 983-985; 1963.

75. Hobson, J.P. Pumping at solid surfaces. Brit. J. Appl. Phys. 14: 544-554; 1963.

76. Hobson, J.P. and Armstrong, R.A. A study of physical adsorption at very low pressures using ultrahigh vacuum techniques. J. Phys. Chem. 67: 2000-2008; 1963.

77. Khan, I.H., Hobson, J.P. and Armstrong R.A. Reflection and diffraction of slow electrons from single crystals of tungsten. Phys. Rev. 129: 1513-1523; 1963.

78. Redhead, P.A. The surface potential of nitrogen on tungsten. J. Chem. Phys. 38: 566-567; 1963.

79. Redhead, P.A. The effects of absorbed oxygen on measurements with ionization gauges. Vacuum, 13: 253-258; 1963.

80. Robins, J.L. Mass peaks from adsorbed gases in a single-focussing mass spectrometer. Can. J. Phys. 41: 1385-1387; 1963.

81. Stoicheff, B.P. and Szabo, A. Interference rings in ruby maser beams. Appl. Opt. 2: 811-815; 1963.

82. Szabo, A. Microwave maser action in ruby at 78°K by laser pumping. Proc. IEEE, 51: 1037-1038; 1963.

83. Szabo, A. Microwave maser action in ruby at 78°K by laser pumping. Proc. Optical Maser Symp. pp. 627-634, 1963.

84. Domeij, B., Brown, F., Davies, J.A., Piercy, G.R. and Kornelsen, E.V. Anomalous penetration of heavy ions of keV energies in monocrystalline tungsten. Phys. Rev. Lett. 12: 363-366, 1964.

85. Hobson, J.P. Measurements with a modulated Bayard-Alpert gauge in aluminosilicate glass at pressures below 10^{-12} Torr. J. Vac. Sci. Technol. 1(1): 1-6; 1964.

86. Kornelsen, E.V. The ionic entrapment and thermal desorption of inert gases in tungsten for kinetic energies of 40 eV to 5 keV. Can. J. Phys. 42: 364-381; 1964.

87. Kornelsen, E.V., Brown, F., Davies, J.A., Domeij, B. and Piercy, G.R. Penetration of heavy ions of keV energies into monocrystalline tungsten. Phys. Rev. 136: A849-858; 1964.

88. Kornelsen, E.V. Der einbau von edelgasionen in wolfram und deren thermische desorption (0-5 keV). Vackuum-Technik, 13: 6-10; 1964.

89. Redhead, P.A. Interaction of slow electrons with chemisorbed oxygen. Can. J. Phys. 42: 886-905; 1964.

90. Redhead, P.A. Desorption of CO and O^+ from polycrystalline Mo surfaces by slow electron impact. Appl. Phys. Lett. 4: 166-167; 1964.

91. Rigby, L.J. The interaction of nitrogen and carbon monoxide on polycrystalline tungsten. Can. J. Phys. 42: 1256-1269; 1964.

92. Szabo, A. Time dependence of ruby laser emission at 78°K. J. Appl. Phys. 35: 2263-2264; 1964.

93. Armstrong, R.A. The surface potential of carbon monoxide adsorbed on tungsten (211) crystal. Report on the Twenty-Fifth Annual Conf. on Phys. Electronics, pp. 209-213; 1965.

94. Edmonds, T.E. and Hobson, J.P. A study of thermal transpiration using ultrahigh vacuum techniques. J. Vac. Sci. Technol. 2: 182-197; 1965.

95. Hobson, J.P. A new method for finding heterogeneous energy distributions from physical adsorption isotherms. Can. J. Phys. 43: 1934-1940; 1965.

96. Hobson, J.P. Analysis of physical adsorption isotherms on heterogeneous surfaces at very low pressures. Can. J. Phys. 43: 1941-1950; 1965.

97. Hobson, J.P. Concerning an analytic expression for the thermal transpiration ratio. Vacuum, 15: 543-544; 1965.

98. Hobson, J.P. and Redhead, P.A. Low pressure limits of hot-filament ionization gauges. J. Vac. Sci. Technol. 2: 93-94; 1965.

99. Ishikawa, K. Voltage dependence of Bayard-Alpert gauge characteristics. Jpn. J. Appl. Phys. 4: 461-465; 1965.

100. Redhead, P.A. Oscillations in magnetically confined cold-cathode discharges at very low pressures. Can. J. Phys. 43: 1001-1014; 1965.

101. Redhead, P.A. and Hobson, J.P. Total pressure measurements below 10^{-10} Torr with non-magnetic ionization gauges. Brit. J. Appl. Phys. 16: 1555-1566; 1965.

102. Rigby, L.J. The chemisorption of nitrogen on polycrystalline tungsten wire. Can. J. Phys. 43: 532-546; 1965.

103. Rigby, L.J. The absorption and replacement of hydrogen on polycrystalline tungsten. Can. J. Phys. 43: 1020-1035; 1965.

104. Szabo, A. and Stein, R.A. Theory of laser giant pulsing by a saturable absorber. J. Appl. Phys. 36: 1562-1566; 1965.

105. Szabo, A. and Igarashi, T. Effect of ground state ESR saturation on a ruby laser output at 90°K. Appl. Phys. Lett. 7: 289-290; 1965.

106. Armstrong, R.A. The reflection of slow electrons by hydrogen-covered single crystals of tungsten. Can. J. Phys. 44: 1753-1764; 1966.

107. Armstrong, R.A. The reflection of slow electrons by hydrogen-covered single crystals of tungsten. Report on Twenty-sixth Annual Conf. on Phys. Electronics, 1966. pp. 224-250.

108. Chapman, R. Period of sawtooth ramp extends to 5 hours. Electronics, 39(13): 78; 1966.

109. Chapman, R. Simple limiting circuits for filament protection in experimental electron tubes. Rev. Sci. Instrum. 37(8): 1085; 1966.

110. Chapman, R. Recorder preamplifier for displaying three decades on one linear scale. Rev. Sci. Instrum. 37(12): 1748-1749; 1966.

111. Fenton, E.W. and Woods, S.B. Quantum oscillations of the ultrasonic absorption in magnesium and zinc. Phys. Rev. 151: 424-429; 1966.

112. Hobson, J.P. Theoretical isotherms for physical adsorption at pressures below 10^{-10} Torr. J. Vac. Sci. Technol. 3: 281-284; 1966.

113. Edmonds, T. and Hobson, J.P. A study of thermal transpiration using ultra-high vacuum techniques. Trans. of the 3rd International Vacuum Congress, 2(1): 75-78; 1966.

114. Hobson, J.P. and Earnshaw, J.W. Mass 1 peak in ionization sources at very low pressures. Can. J. Phys. 44: 2531-2532; 1966.

115. Kornelsen, E.V. and Domeij, B. Simple differential pumping stage for connecting high to ultra-high vacuum systems. J. Vac. Sci. Technol. 3(1): 20-24; 1966.

116. Kornelsen, E.V. Developments in the measurement of low pressures. Trans. 3rd Int. Vac. Congress 1: 65-73, 1966 (Pergamon Press).

117. Kornelsen, E.V. and Sinha, M.K. Thermal desorption of inert gases from tungsten monocrystals. Appl. Phys. Lett. 9(3): 112-114; 1966.

118. Redhead, P.A. New hot-filament ionization gauge with low residual current. J. Vac. Sci. Technol. 3(4): 173-180; 1966.

*119. Erickson, L.E. Electron-paramagnetic-resonance absorption by trivalent neodymium ions in single crystals of lanthanum trichloride and lanthanum ethyl sulphate in zero magnetic field. Phys. Rev. 143: 295-303; 1966.

120. Erickson. L.E. and Szabo, A. Effects of saturable absorber lifetime on the performance of giant-pulse lasers. J. Appl. Phys. 37(13): 4953-4961; 1966.

121. Armstrong, R.A. The adsorption of hydrogen on (100) tungsten single crystal surfaces. Letters to the Editor, Surf. Sci. 6: 470; 1967.

* Paper published while author member of Electron Physics Section, but work done elsewhere.

122. Fenton, E.W. and Haering, R.R. Magnetic-field-induced Mott transition in semiconductors. Phys. Rev. 159: 593-598; 1967.

123. Hobson, J.P. and Earnshaw, J.W. Pressure equations for the residual gases in an ultrahigh vacuum system. J. Vac. Sci. Technol. 4(5): 257-273; 1967.

124. Hobson, J.P. and Armstrong, R.A. A study of physical adsorption at very low pressures using ultra-high vacuum techniques. J. Phys. Chem. 67: 2000-2008; 1963, reprinted in Series of Selected Papers in Physics, Physics and Technology of Ultrahigh Vacuum, Phys. Soc. Japan, 1967.

125. Johnston, D. A dual-purpose glass blowing torch. J. Sci. Instrum. 44: 302; 1967.

126. Redhead, P.A. Modulation of hot-cathode ionization gauges. J. Vac. Sci. Technol. 4: 57-62; 1967.

127. Redhead, P.A. Multiple ionization of the rare gases by successive electron impacts (0-250 eV). I. Appearance potentials and metastable ion formation. Can. J. Phys. 45: 1791-1812; 1967.

128. Redhead, P.A. Errors in the measurement of pressure with ionization gauges. Vacuum Technology Trans., Proc. Seventh Nat. Symp. 7: 108-111; 1960, reprinted in Series of Selected Papers in Physics, Physics and Technology of Ultrahigh Vacuum, Phys. Soc. Japan, 1967.

129. Redhead, P.A. Electron impact desorption of CO from tungsten. Nuovo Cimento, Suppl. 5: 586-597; 1967.

130. Redhead, P.A. Achievements and future trends in research concerned with vacuum problems. Scinteia, Bucharest, 1967.

131. Redhead, P.A. and Hobson, J.P. Total pressure measurements below 10^{-10} Torr with non-magnetic ionization gauges. Brit. J. Appl. Phys. 66: 1555-1566; 1965, reprinted in Series of Selected Papers in Physics, Physics and Technology of Ultrahigh Vacuum, Phys. Soc. Japan, 1967.

132. Siemsen, K.J. and Fenton, E.W. Optical absorption by excitons in amorphous selenium. Phys. Rev. 161(3): 632-666; 1967.

133. Szabo, A. and Igarashi, T. Ground state ESR measurements of ruby during laser action. IEEE J. Quantum Electron. QE-3(4): 143-150; 1967.

134. Szabo. A. and Erickson, L.E. Behaviour of saturable absorber giant pulse lasers in the limit of large absorber cross section. J. Appl. Phys. 38(6): 2540-2542; 1967.

135. Szabo, A. Comment on 'The effect of absorber concentration on a pulse-laser system'. J. Appl. Phys. 38(8): 3395; 1967.

136. Armstrong, R.A. CO adsorption on (100) and (211) tungsten single-crystal surfaces: changes in work function. Can. J. Phys. 46: 949-958; 1968.

137. Chapman, R. Period of sawtooth ramp extends to 5 hours. Reprinted in Source Book of Electronic Circuits (Marcus) 1968.

138. Chapman, R. UJT protects OP amp from voltage transients. Electronics, 41(24): 83; 1968.

139. Earnshaw, J.W. and Hobson, J.P. Experimental test of surface phase theory for ultrahigh vacuum systems. J. Vac. Sci. Technol. 5(1): 19-22; 1968.

140. Fenton, E.W. Excitonic insulator in a magnetic field. Phys. Rev. 170: 816-821; 1968.

141. Fenton, E.W. Possible cooperative phase for electrons in double-stranded DNA. Phys. Rev. 174(2): 517-521; 1968.

142. Fenton, E.W. Overhauser phase and bond alternation in long-chain molecules. Phys. Rev. Lett. 21: 1427-1430; 1968.

143. Hobson, J.P. and Earnshaw, J. W. Behavior of hydrogen in ion sources with hot filaments at very low pressures. Can. J. Phys. 46: 2517-2526; 1968.

144. Hobson, J.P. and Earnshaw, J.W. The measurement of hydrogen pressure with a modulated Bayard-Alpert gauge at very low pressures. Proc. 4th Internat. Vacuum Congress. p. 619-622, (The Institute of Physics and the Physical Society, 1968).

145. Hobson, J.P. and Redhead, P.A. Physical processes in vacuum. Proc. 4th Internat. Vacuum Congress. 1968. pp. 3-20.

146. Kornelsen, E.V. and Sinha, M.K. Thermal release of inert gases from tungsten: dependence on the crystal face bombarded. Can. J. Phys. 46: 613-619; 1968.

147. Kornelsen, E.V. and Sinha, M.K. Thermal release of inert gases from a (100) tungsten surface. J. Appl. Phys. 39: 4545-4555; 1968.

148. Redhead, P.A. and Feser, S. Multiple ionization of the rare gases by successive electron impact (0-250 eV). II. 1S-2S transtion in He^{3+}. Can. J. Phys. 46: 865-869; 1968.

149. Redhead, P.A. and Feser, S. Multiple ionization of mercury by successive electron impacts. Can. J. Phys. 46: 1905-1913; 1968.

150. Spencer, C.M. and Stäheli, D. High-stability controller for Bayard-Alpert ionization gauges. J. Vac. Sci. Technol. 5(4): 105-108; 1968.

151. Szabo, A. and Erickson, L.E. Self Q-switching of ruby lasers at 77°K. IEEE J. Quantu Electron. QE-4: 692-698; 1968.

152. Szabo, A. Optical-microwave double-resonance studies of ruby. J. Appl. Phys. 30: 5425-5434; 1968.

153. Armstrong, R.A. The interaction of slow electrons with CO adsorbed on W (100). Proc. 4th International Materials Symposium, Wiley, 1969. pp. 51-1 - 52-12.

154. Chapman, R. Bistable electrical switching behaviour in glasses and other media. Electron. Lett. 5(11): 246; 1969.

155. Chapman, R. Instrumentation for analog differentiation at low frequencies. Rev. Sci. Instrum. 40(1): 95-98; 1969.

156. Fenton, E.W., Jan, J.-P., Karlsson, A. and Singer, R. Ideal resistivity of bismuth-antimony alloys and the electron-electron interaction. Phys. Rev. 184: 663-667; 1969.

157. Hobson, J.P. Surface smoothness in thermal transpiration at very low pressures. J. Vac. Sci. Technol. 6(1): 257-259; 1969.

158. Hobson, J.P. Physical adsorption isotherms extending from ultra-high vacuum to vapor pressure. J. Phys. Chem. 73: 2720-2727; 1969.

159. Hobson, J.P. and Williams, B.R. Cryosorption pumping of helium on porous silver at 4.2°K. J. Vac. Sci. Technol. 6: 965-967; 1969.

160. Kornelsen, E.V. Ionic entrapment in tungsten monocrystals; a survey of effects observed in thermal desorption. J. Vac. Sci. Technol. 6(1): 173-174; 1969.

161. Kornelsen, E.V. and Sinha, M.K. Thermal release of inert gases from (110) and (211) tungsten surfaces. J. Appl. Phys. 40: 2888-2894; 1969.

162. Redhead, P.A. Multiple ionization in carbon monoxide by successive electron impacts. Can. J. Phys. 47(22): 2449-2457; 1969.

163. Redhead, P.A. The sensitivity of Bayard-Alpert gauges. J. Vac. Sci. Technol. 6: 848-854; 1969.

164. Redhead, P.A. Ultra high vacuums, much ado about almost nothing. Science Forum, 2(6): 16-17; 1969.

165. Redhead, P.A. Invention and inventors. Scienteia Almanac, p. 62, 1969.

166. Szabo, A. and Erickson, L.E. Study of saturable absorber switching efficiencies. J. Appl. Phys. 40(9): 3574-3581; 1969.

167. Erickson, L.E. and Spencer, C.M. A high-stability, programmed, solid-state pulsed-laser power supply. Electron. Eng. 42(505): 36-38; 1970.

168. Fenton, E.W., Jan, J.P. and Karlsson, A. Magnetic-field induced semiconductor - semimetal transition in Bi-Sb alloys. J. Low Temp. Phys. 3: 147-174; 1970.

160. Gopalaraman, C.P., Armstrong, R.A., and Redhead, P.A. Sensitivity variations in Bayard-Alpert gauges caused by Auger emission at the collector. J. Vac. Sci. Technol. 7: 195-198; 1970.

170. Hobson, J.P. Accommodation pumping - a new principle for low pressures. J. Vac. Sci. Technol. 7: 351-357; 1970.

171. Hobson, J.P. Vibrating ribbon pressure gauge. J. Vac. Sci. Technol. 7: 557-558; 1970.

172. Kornelsen, E.V. Entrapment of helium ions at (100) and (110) tungsten surfaces. Can. J. Phys. 48: 2812-2823; 1970.

173. Redhead, P.A. Ion desorption by electron bombardment; relation to total and partial pressure measurements. J. Vac. Sci. Technol. 7: 182-187; 1970.

174. Redhead, P.A. Sequential-impact mass spectrometry: pressure dependence of ion currents from trapped-ion sources. Can. J. Phys. 48: 1906-1916; 1970.

175. Redhead, P.A. and Armstrong, R.A. Techniques for analysis of structure and composition of adsorbed layers. Nederlands Tijdschrift voor Vacuumtechniek, 8(6): 145-155; 1970.

176. Szabo, A. Laser-induced fluorescence-line narrowing in ruby. Phys. Rev. Lett. 25(14): 924-926; 1970.

177. Szabo, A. Optical pumping of ruby by laser resonance radiation. Doctoral Thesis, Tohoku University Graduate School, Sendai, Japan. November 1970.

178. Erickson, L.E. and Szabo, A. Spectral narrowing of dye laser output by injection of monochromatic radiation into the laser cavity. Appl. Phys. Lett. 18: 433-435; 1971.

179. Fenton, E.W. and Jan, J.P. Magnetic-field-induced semiconductor-semimetal transition in bismuth-antimony alloys. J. Phys. Chem. Solids 32, Suppl. 1: 115-119: 1971

180. Gopalaraman, C.P. and Redhead, P.A. Multiple ionization of cesium and barium by successive electron impacts. Can. J. Phys. 49(5): 585-593; 1971.

181. Hobson, J.P. Analysis of accommodation pumps. J. Vac. Sci. Technol. 8: 290-293; 1971.

182. Hobson, J.P. Design parameters of accommodation pumps. Vacuum, 21: 527; 1971.

183. Hobson, J.P. and Chapman, R. The onset of Henry's Law for physical adsorption of a vapor on a heterogeneous surface. Adsorption-Desorption Phenomena (Edited by F. Ricca), pp. 33-47. Acad. Press, London, 1972. Volume represents the Proceedings of the 2nd International Conference on Adsorption Desorption Phenomena, Florence, Italy, April 1971.

184. Redhead, P.A. Sequential impact mass spectrometry: estimates of metastable ion cross-sections. Can. J. Phys. 49: 585; 1971.

185. Leggett, M.R. and Armstrong, R.A. A study of hydrogen on a (100) tungsten surface using a simple HEED system. Surf. Sci. 24: 404-416; 1971.

186. Szabo, A. Observation of the optical analog of the Mössbauer effect in ruby. Phys. Rev. Lett. 27(6): 323-326; 1971.

187. Williams, B.R. On the elastic and inelastic scattering of neon atoms by a (100) surface of lithium fluoride at 150°K. J. Chem. Phys. 55: 1315-1322; 1971.

188. Williams, B.R. Scattering of helium atoms by phonons in the (001) surface of LiF at 150°K. J. Chem. Phys. 55: 3220-3235; 1971.

189. Ballu, Y., Armstrong, R.A. and Lecante, J. Propriétés vibrationnelles de molécules adsorbées sur un monocristal de tungstène, observées par réflexion inélastique d'électrons lents. C.R. Acad. Sci. Paris, 274: 718-720; 1972.

190. Chapman, R. Versatile wide range electron current regulator. Rev. Sci. Instrum. 43(10): 1536-1538; 1972.

191. Erickson, L.E. On anti-Stokes luminescence from Rhodamine 6G in ethanol solutions. J. Lumin. 5: 1-13; 1972.

192. Fenton, E.W. Comments on the paper by H, Miwa et al., "The de Haas - van Alphen effect in a Kondo system". Solid State Commun. 10: 185-189; 1972.

193. Fenton, E.W. Electrical resistivity of semimetals in the extreme quantum limit. J. Low Temp. Phys. 7: 425-442; 1972.

194. Fenton, E.W. Magnetic field depreciation of a Kondo system. Phys. Rev. B, 5(9): 3788-3790; 1972.

195. Hobson, J.P. and Pye, A.W. Physical factors influencing accommodation pumps. J. Vac. Sci. Technol. 9: 252-256; 1972.

196. Hobson, J.P. Pompage cryogènique-une synthèse. Supplement to "Le Vide", No. 157, 201-213; 1972. Volume represents Proceedings of the Conference of the French Society of Vacuum Engineers and Technicians, Versailles, France, May 1972.

197. Hobson, J.P. Surface phenomena at low pressures and temperatures. Am. Inst. Chem. Eng. Symposium Series, 68(125): 16-23; 1972.

198. Kornelsen, E.V. The interaction of injected helium with lattice defects in a tungsten crystal. Radiat. Eff. 13: 227-236; 1972.

199. Mason, B.F. and Williams, B.R. Molecular beam system for gas-surface scattering studies. Rev. Sci. Instrum. 43(3): 375-383; 1972.

200. Mason, B.F. and Williams, B.R. The establishment of an ordered array of physisorbed ethanol molecules on lithium fluoride as evidenced by the diffraction of helium atoms. J. Chem. Phys. 56(5): 1895-1904; 1972.

201. Mason, B.F. and Williams, B.R. Scattering of thermal helium atoms from a mercury film deposited on a lithium fluoride substrate. J. Chem. Phys. 57: 872-884; 1972.

20. Mason, B.F. and Williams, B.R. The thermal etching of LiF and its effects on the scattering of atomic beams. Surf. Sci. 33: 326-344; 1972.

203. Redhead, P.A. and Richardon, G.W. Photon appearance potential spectroscopy of thorium. J. Appl. Phys. 43: 2970-2972; 1972.

204. Szabo, A. and Erickson, L.E. Laser induced fluorescence line narrowing in iodine. Opt. Commun. 5: 287-290; 1972.

205. Edwards, D., Jr. Non-perturbative approach to hyperfine splitting. Phys. Lett. 45A(5): 385-386; 1973.

206. Hobson, J.P. Cryopumping. J. Vac. Sci. Technol. 10: 73; 1973.

207. Hobson, J.P., Baker, B.G., and Pye, A.W. Further measurements on physical factors influencing accommodation pumps. J. Vac. Sci. Technol. 10: 241; 1973.

208. Armstrong, R.A. A study of titanium films by Auger electron spectroscopy. Int. Symp. on Characterization of Adsorbed Species in Catalytic Reactions, University of Ottawa, Ottawa, Ontario. June 17-20, 1974. No. 10: 1-5; 1974.

209. Armstrong, R.A. Génération du méthane dans les pompes à titane. Journées de technologie du vide (Suppl. à "Le Vide"), pages 11-14; juin 1974.

210. Chapman, R. Reply to reliability improvement in Chapman's regulator. Rev. Sci. Instrum. 45(11): 1481; 1974.

211. Edwards, D., Jr. The influence of vacuum specific time constants on thermal desorption experiments. J. Vac. Sci. Technol. 11:(6): 1141-1143; 1974.

212. Edwards, D.E. and Kornelsen, E.V. The kinetics of the desorption of helium implanted into a nickel (100) crystal. Surf. Sci. 44: 1-10; 1974.

213. Hobson, J.P. Physical adsorption. CRC Critical Review in Solid State Sciences, 4: 221-245; 1974.

214. Hobson, J.P. Survey of ultrahigh vacuum instruments for surface studies. Internal Symposium on Characterization of Adsorbed Species in Catalytic Reactions, University of Ottawa, Ottawa, Ontario. June 17-20, 1974. No. 6: 1-6; 1974.

215. Hobson, J.P. The relationship of solid surfaces to vacuum science and technology. Proc. 6th Intern. Vacuum Congress, Kyoto, Japan. Jpn. J. Appl. Phys. Suppl. 2, Part 1: 317-325; 1974.

216. Hobson, J.P. Ultrahigh vacuum and solid-gas interface. J. Colloid Interface Sci. 47: 375-378; 1974.

217. Hobson, J.P. Ultrahigh vacuum and the solid-gas interface. Adv. Colloid Interface Sci. 4: 79-101; 1974.

218. Kornelsen, E.V. and Edwards, D.E., Jr. Observations of ion bombardment damage in a Ni(100) crystal by helium ion injection: Applications of ion beams to metals. Edited by S.T. Picraux, E.P. EerNisse and F.L. Vook. Plenum Publishing Co., New York. 1974. pp. 521-529.

219. Kornelsen, E.V. and O'Hara, D.H. Analysis of thermal desorption spectra using a computer graphic system. J. Vac. Sci. Technol. 11(5): 885-888; 1974.

220. Mason, B.F. and Williams, B.R. The scattering of helium atoms from adsorbed layers of molecules on a (001) surface of NaF. Surf. Sci. 45: 141-162; 1974.

221. Mason, B.F. and Williams, B.R. The inelastic scattering of He and Ne from (001) surface of sodium fluoride. J. Chem. Phys. 61: 2765-2778; 1974.

222. Mason, B.F. and Williams, B.R. The inelastic scattering of He from a (001) surface of sodium fluoride. Japanese J. Appl. Phys. Suppl. 2, Part 2: 557-562; 1974.

223. Szabo, A. CW excited state absorption in ruby. Opt. Commun. 12(4): 366-367; 1974.

224. Szabo, A. Sideband detection of optical hole burning in ruby. IEEE J. Quantum Electron. QE-10(9): 747-748; 1974 (extended abstract).

225. Takeuchi, N. and Szabo, A. Observation of photon echoes using a nitrogen laser pumped dye laser. Phys. Lett. 50A(5): 361-362; 1974.

226. Wood, B.M., Mason, B.F., and Williams, B.R. Scattering of He and Ne atoms from a (001) surface of sodium fluoride. J. Chem. Phys. 61: 1435-1454; 1974.

227. Armstrong, R.A. Auger electron spectroscopy of layered growth of titanium. Surf. Sci. 50: 615-620; 1975.

228. Armstrong, R.A. Elastic and inelastic reflection coefficients of tungsten surfaces. Surf. Sci. 47: 666-668; 1975.

229. Chapman, R. Simple gas activity detector for use in vacuum systems. J. Vac. Sci. Technol. 12(3): 723-724; 1975.

230. Edwards, D.E. Jr. and Kornelsen, E.V. Vacancy creation by low energy ion bombardment. Radiat. Eff. 26: 155-160; 1975.

231. Edwards, D.E. Jr. An analysis of the thermal desorption spectra of inert gas ions implanted into a nickel (100) crystal. J. Appl. Phys. 46(4): 1444-1447; 1975.

232. Edwards, D.E. The effects of sample readsorption on thermal desorption experiments. Surf. Sci. 49: 393-400; 1975.

233. Edwards, D.E. Thermal desorption of implanted inert gas ions from nickel. J. Vac. Sci. Technol. 12(1): 476-480; 1975.

234. Edwards, D.E. Thermal desorption spectra of inert gas ions implanted into a nickel (100) crystal. J. Appl. Phys. 46(4): 1437-1443; 1975.

235. Erickson, L.E. Fluorescence line narrowing of trivalent praseodymium in lanthanum trifluoride - the resonant transitions. Opt. Commun. 15(2): 246-249; 1975.

236. Erickson, L.E. Fluorescence line narrowing of trivalent praseodymiun in lathanam trifluoride single crystal - Phonon induced relaxation. Phys. Rev. B, 11(1): 77-81; 1975.

237. Hobson, J.P. Alternative interpretation of the measurements of specific outgassing rates of materials. Proc. Isabelle Summer Study, 2: 652-660; 1975. Brookhaven National Laboratory, Upton, N.Y. (July 14-25).

238. Hobson, J.P. Demountable ultrahigh vacuum sections. Proc. Isabelle Summer Study, 2: 690-693; 1975. Brookhaven National Laboratory, Upton, N.Y. (July 14-25).

239. Hobson, J.P. Summary report of working group on vacuum system. Proc. Isabelle Summer Study, 1: 151; 1975. Brookhaven National Laboratory, Upton, N.Y.

240. Szabo, A. and Takeuchi, N. Self-induced transparency in Pr^{3+}:LaF_3. Opt. Commun. 15(2): 250-253; 1975.

241. Szabo, A. Characteristics of an argon-laser pumped ruby laser. J. Appl. Phys. 46(2): 802-807; 1975.

242. Szabo, A. Observation of hole burning and cross relaxation in ruby. Phys. Rev. B, 11(11): 4512-4517; 1975.

243. Takeuchi, N. Photon-echo behavior in the presence of extreme inhomogeneous broadening. IEEE J. Quantum Electron. QE-11(6): 230-235; 1975.

244. Armstrong, R.A. Diffraction methods. In Experimental Methods in Catalytic Research, Vol. 3. Characterization of Surfaces and Adsorbed Species. Academic Press Inc., New York, N.Y. 1976. pp. 121-148.

245. Kornelsen, E.V. An ion gun with relatively high yield at low pressure ($<10^{-3}$Pa). J. Vac. Sci. Technol. 13(3): 716-720; 1976.

246. O'Hara, D.H. and Kornelsen, E.V. An application of interactive computer graphics in experimental physics: The analysis of thermal desorption spectra. Int. J. Man-Mach. Stud. 8: 149-157; 1976.

247. Sexton, B.A., Baker, B.G., and Armstrong, R.A. Auger spectroscopic study of nickel films on Pyrex. J. Vac. Sci. Technol. 13: 1144-1151; 1976.

248. Szabo, A. and Kroll, M. Electric field induced shifting of optical holes, fluorescence line narrowing and free induction decay in ruby. Opt. Commun. 18(2): 224-225; 1976.

249. Takeuchi, N. Measurement of the relaxation time in LaF_3:Pr^{3+} by photon echo. J. Lumin. 12/13: 734-747; 1976.

250. Armstrong, R.A. A study of evaporated films of titanium and molybdenum by Auger electron spectroscopy. 6th Can. Seminar on Surfaces, 1977. p. 12.

251. Chapman, R. and Blair, D.L. Crystal heater supply utilizing controlled electron bombardment. Rev. Sci. Intrum. 48(7): 939-941; 1977.

252. Erickson, L.E. Optical measurement of the hyperfine splitting of the $^1D_2$ metastable state of Pr^{3+} by enhanced and saturated absorption spectroscopy. Phys. Rev. B, 16: 4731-4736; 1977.

253. Erickson, L.E. The nuclear quadrupole interaction in Pr^{3+}:LaF_3 - An optical RF double resonance measurement of the ground state electronic state. Opt. Commun. 21(1): 147-149; 1977.

254. Erickson, L.E. The nuclear quadrupole interaction in Pr^{3+}: LaF_3 - An optical RF double resonance measurement of the ground state electronic state. Bull. Am. Phys. Soc. 22(1): 79; 1977.

255. Hobson, J.P. A target transfer vacuum system at ultrahigh vacuum. Digest of VI Canadian Seminar on Surfaces, Queen's University, Kingston, Ontario. 1977. p. 13.

256. Hobson, J.P. and Kornelsen, E.V. A target transfer system at ultrahigh vacuum. Proc. 7th Int. Vacuum Congress and 3rd Int. Conf. on Solid Surfaces, Vienna. Vol. 3: 2663-2666; 1977.

257. Hobson, J.P. Methods of improving vacuum in space. J. Vac. Sci. Technol. 14(6): 1279-1280; 1977.

258. Kornelsen, E.V. and Blair, D.L. Apparatus for the detection of small numbers of desorbing inert gas atoms. J. Vac. Sci. Technol. 14(6): 1299-1302; 1977.

259. Kornelsen, E.V. and Blair, D.L. High sensitivity thermal desorption apparatus. Digest of 6th Can. Seminar on Surfaces, Queen's University, Kingston, Ontario. 1977. p. 36.

260. Kornelsen, E.V., Van Veen, A., Caspers, L.M. and Bakker, H. Thermal release of injected helium $Co_{56}Ga_{44}$. Phys. Status Solidi, 39: K143-K146; 1977.

261. Mitchell, D.F. and Sewell, P.B. Simultaneous RHEED and X-ray emission analysis of reacting surfaces. Proc. 7th International Vacuum Congress and 3rd International Conf. on Solid Surfaces, Vienna, 1977. pp. 947-950.

262. Mitchell, D.F. and Sewell, P.B. and Cohen, M. A kinetic study of the initial oxidation of the Ni(110) surface by RHEED and X-ray emission. Surf. Sci. 69: 310-324; 1977.

263. Sewell, P.B. and Ramachandran, K.N. A source of imaging detector for the scanning electron microscope. Proc. 10th Annual Scanning Electron Microscope Symposium, IITRI, Chicago, Ill. March, 1977. Scanning Electron Microscopy, 1: 17-24; 1977.

264. Szabo, A. Repetitive self-Q-switching in a continuously pumped ruby laser. J. Appl. Phys. 49(2): 533-538; 1977.

265. Van Veen, A., Caspers, L.M., Kornelsen, E.V., Fasteneau, R., and van Gorkum, A. Vacancy creation by helium trapping at substitutional krypton in tungston. Phys. Status Solidi, A, Appl. Res. 40: 235-245; 1977.

266. Yamagishi, A. and Szabo, A. Electronically tuned pulsed dye laser. Appl. Opt. 16(3): 691-694; 1977.

267. Erickson, L.E. A measurement of the hyperfine splittings of the $^1D_2$ metastable state of Pr^{3+}:LaF_3 by enhanced and saturated absorption spectroscopy. J. Semicond. Insul., special issue Dec. 77, published by Gordon and Breach, New York. 3(2-3): 235-247; 1978.

268. Hobson, J.P. First intercontinental test of UHV transfer device. J. Vac. Sci. Technol. 15: 1609-1611; 1978.

269. Mason, B.F. and Williams, B.R. Atomic beam spectrometer using a LiF analyzer crystal. Rev. Sci. Instrum. 49(7): 897-904; 1978.

270. Mason, B.F. and Williams, B.R. Scattering of He and Ne atoms from Cu(001) at 20°K. Surf. Sci. 75(4): L786-L795; 1978.

271. Mason, B.F. and Williams, B.R. The inelastic scattering of He from Cu(001) at 20°K. Surf. Sci. 77(3): 385-399; 1978.

272. Sewell, P.B. and Ramachandran, K.N. Grid aperture contamination in electron guns using directly heated lanthanum hexaboride sources. Scanning Electron Microscopy/1978, Vol.1, pp. 221-231.

273. Szabo, A. and Kroll, M. Stark-induced optical transients in ruby. Opt. Lett. 2: 10-12; 1978.

274. Yamagishi, A. and Szabo, A. Concentration independence of photon echo lifetimes in Pr^{3+}:LaF_3. Opt. Lett. 2: 160-162; 1978.

275. Chapman, R. and Moore, S.E. Voltage multiplication circuit for starting uv source gas discharge lamps. Rev. Sci. Instrum. 50(3): 384-385; 1979.

276. DeVoe, R.G., Szabo, A., Rand, S.C., and Brewer, R.G. Ultraslow optical dephasing of LaF_3:Pr^{3+}. Phys. Rev. Lett. 42(23): 1560-1563; 1979.

277. DeVoe, R.G., Szabo, A., Rand, S.C. and Brewer, R.G. Ultraslow optical dephasing of LaF_3:Pr^{3+}. Laser Spectroscopy IV, Edited by H. Walther and R.W. Rothi, Springer-Verlag, Berlin. 1979. pp. 398-430.

278. Hobson, J.P. and Kornelsen, E.V. UHV technique for intervacuum sample transfer. J. Vac. Sci Technol. 16: 701-707; 1979.

279. Hobson, J.P. Methods of producing ultrahigh vacuums and measuring ultralow pressures. Surface and Colloid Science, Vol. 11. Edited by R.J. Good and R.R. Stromberg. Plenum Publishing Corp. 1979. pp. 187-215.

280. Hobson, J.P. On the difference between true and net outgassing rates. J. Vac. Sci. Technol. 16(1): 84-86; 1979.

281. Hobson, J.P. On minimizing outgassing of the wake shield. NASA Conf. Marshall Space Flight Center, Alabama, June 1979. Pub. No. NASA CP-2091, pp. D-II-35 - D-II-45.

282. Hobson, J.P. The implications of "true" and "net" outgassing rates for the wake shield experiment. NASA Conf., Marshall Space Flight Center, Alabama, June 1979. Pub. No. NASA CP-2091, pp. III-9 - III-11.

283. Hobson, J.P. Alternative interpretation of the measurements of specific outgassing rates of materials. NASA Conf., Marshall Flight Center, Alabama, June 1979. Pub. No. NASA CP-2091. pp. III-1 - III-8.

284. Hobson, J.P. Cryopumping. In Short Course in Vacuum Science and Technology, American Vacuum Society, 1979. (Appeared originally in J. Vac. Sci. Technol. 10: 73; 1973, republished in its entirety.)

285. van Gorkum, A.A. Channeling computations for low energy (25-2500 eV) helium in tungsten. Phys. Lett. A, 75(1,2): 134-136; 1979.

286. Armstrong, R.A. The dissociation and solution of carbon monoxide at the Mo(100) surface. Proc. 8th Int. Vacuum Congr., 4th Int. Conf. on Solid Surfaces and 3rd European Conf. on Surface Science, Cannes 1980. Edited by D.A. Degras and M. Costa. pp. 478-481.

287. Erickson, L.E. A three axis computer controlled low field magnet for optical and magnetic resonance studies. Rev. Sci. Instrum. 51(8): 1095-1097; 1980.

288. Hobson, J.P. and Kornelsen, E.V. Application of a vacuum transfer device for exchange of surface standards. Applied Surface Analysis, ASTM, STP 699, Edited by T.L. Barr and L.E. Davis. American Society for Testing and Materials, 1980. pp. 148-157.

289. Hobson, J.P. Performance of a combined magnetron pump-gauge at ultrahigh vacuum. Surf. Sci. 100: 273-280; 1980.

290. Jessop, P.E. and Szabo, A. High resolution measurements of the ruby R line at low temperatures. Opt. Commun. 33(3): 301-302; 1980.

291. Jessop, P.E. and Szabo, A. Search for the Anderson transition in ruby. J. Opt. Soc. Am. 70(6): 633-634; 1980.

292. Jessop, P.E. and Szabo, A. Single frequency CW dye laser operation in the 690-700 nm gap. IEEE J. Quantum Electron. QE-16(8): 812-813; 1980.

293. Jessop, P.E. and Szabo, A. Visual observations of macroscopic inhomogeneous broadening of the R line in ruby. Appl. Phys. Lett. 37: 510-512; 1980.

294. Jessop, P.E. and Szabo, A. Resonant optical energy transfer in ruby. Phys. Rev. Lett. 45(21): 1712-1715; 1980.

295. Jessop, P.E., Muramoto, T., and Szabo, A. Optical hole burning in ruby. Phys. Rev. B, 21(3): 926-936; 1980.

296. Kornelson, E.V. and van Gorkum, A.A. A study of bubble nucleation in tungsten using thermal desorption spectrometry: clusters of 2 to 100 helium atoms. J. Nucl. Mater. 92: 79-88; 1980.

297. Kornelson, E.V. and van Gorkum, A.A. Enhanced penetration of low energy (25 eV - 5000 eV) helium along the 100 channel in tungsten. Nucl. Inst. Methods, 170: 161-170; 1980.

298. Kornelsen, E.V. and van Gorkum, A.A. Attachment of mobile particles to non-saturable traps: I. A theoretical model. Radiat. Eff. 52: 24-34; 1980.

299. Kornelsen, E.V. and van Gorkum, A.A. Attachment of mobile particles to non-saturable traps: II. The trapping of helium of xenon atoms in tungsten. Radiat. Eff. 42: 113-124; 1980.

300. Sau, R. The oxidation of graphitic monolayer on Ni(110). Surf. Sci. 95: 465-476; 1980.

301. Sewell, P.B. High brightness thermionic guns for electron microscopes. Scanning Electron Microsc. 1980/I: 11-24; 1980.

302. Sewell, P.B., Champness, C.H., El Azab, M., and Gennaoui, F. Extent of CdSe presence at "formed" Se-Cd contacts. Philos. Mag. B, 42(2): 315-318; 1980.

303. Sharma, K.K. and Erickson, L.E. NMR measurement of the hyperfine constant of an excited state of an impurity ion in a solid. Phys. Rev. Lett. 45(4): 294-297; 1980. NRC 18724.

304. van Gorkum, A.A. A new method for analyzing 1st and 2nd order desorption spectra and glow curves. J. Appl. Phys. 51(5): 2594-2602; 1980.

305. van Gorkum, A.A. and Kornelsen, E.V. The entrance probability and range of helium in W(100) for energies 8 eV to 5000 eV as measured by thermal desorption spectrometry. Radiat. Eff. 52: 25-34; 1980.

306. van Gorkum, A.A. and Kornelsen, E.V. The entrance probability and range of helium in W(100) for energies 8 eV to 5000 eV as measured by thermal desorption spectrometry. Proc. 8th Int. Vacuum Congr., 4th Int. Conf. on Solid Surfaces and 3rd European Conf. on Surface Science, Cannes 1980. Edited by D.A. Degras and M. Costa. pp. 1415-1418.

307. Eberly, J.H., Hartmann, S.R., and Szabo, A. Propagation narrowing in the transmission of a light pulse through a spectral hole. Phys. Rev. A, 23(5): L 2502-2506: 1981.

308. Erickson, L.E. Addendum to "Hyperfine interaction in the lowest levels of the H and D states of trivalent praseodymium in yttrium aluminum perovskite (YAlO)". Phys. Rev. B, 24(9): 5388-5390; 1981.

309. Erickson, L.E. and Sharma, K.K. Nuclear quadrupole resonance measurements of the anisotropic magnetic shielding and quadrupole coupling constants of $^{151}Eu^{3+}$ and $^{153}Eu^{3+}$ dilute in YAlO single crystal. Phys. Rev. B, 24(7): 3697-3700; 1981.

310. Erickson, L.E. and Sharma, K.K. Hyperfine studies of rare earth ions dilute in optical solids. Laser Spectroscopy V, p 429, Springer Verlag 1981.

311. Jessop P.E. and Szabo A. Optical hole burning and ground state energy transfer in ruby. Laser spectroscopy V, Proc, of the Fifth International Conference, Jasper, Alberta, Canada, June 29 - July 3, 1981. Springer Verlag, Berlin. pp. 408-411.

312. Lipsett, F.R. Book review - Crystals: growth, properties and applications. Vol. 2, Phys. Can. 37(6): 128-129; 1981.

313. Mason, B.F. and Williams, B.R. Inelastic scattering from a Cu(001) surface and an absorbed layer of Xe atoms at 16 K. Phys. Rev. Lett. 46(17): 1138-1142; 1981.

314. Mason, B.F. and Williams, B.R. Inelastic scattering of He atoms from Cu(001) at low temperature with energy analysis. J. Chem. Phys. 75(5): 2199-2204; 1981.

315. Mason, B.F. and Williams, B.R. The scattering of He atoms from an ordered layer of Xe atoms on Cu(001) with energy analysis. Surf. Sci. 111(3): 609-621; 1981.

316. Mason, B.F., Caudano, R., and Williams, B.R. Off-specular coherent and incoherent elastic scattering from Cu(001) and absorbed layers of CO and Xe. Phys. Rev. Lett. 47(16): 1141-1144; 1981.

317. Sharma, K.K. and Erickson, L.E. Observation of nuclear spin-spin structure in zero and low external static magnetic fields. Phys. Rev. B, 23(1): 69-74; 1981.

318. Sharma, K.K. and Erickson. L.E. Optically detected nuclear magnetic resonance studies of LiYF:Pr in the ground electronic state H. J. Phys. C, 14: 1329-1338; 1981. NRC 19321.

319. Simmonds, W.H.C., DeMarco, F., and Armstrong, R.A. The results of the Industrial Research Assistance Program of the National Research Council of Canada. February 1981. 12 pages.

320. van Gorkum, A.A. and Kornelsen, E.V. Quantitative thermal desorption spectrometry of ionically implanted inert gases. I. Fundamental aspects. Vacuum, 31: 89-98; 1981.

321. van Gorkum, A.A. and Kornelsen, E.V. Quantitative thermal desorption spectrometry of ionically implanted inert gases. II. Technical requirements. Vacuum, 31; 99-111; 1981.

322. van Gorkum, A.A. Quantitative thermal desorption spectrometry of noble gases in solids. Ph.D. Thesis, Delft University Press. 1981. 147 pages.

*323. Szabo, A. High resolution time and frequency domain spectroscopy of solid state laser materials. Proc. Int. Conf. Lasers '80. New Orleans, LA. Dec. 15-19, 1980. pp. 374-382.

*324. Chrostowski, J. Noisy bifurcations in acousto-optic bistability. Phys. Rev. A, 26: 3023-3025; 1982.

*325. Chrostowski, J., Delisle, C., Valle, R., Carrier, D., and Bouley, L. Multistable non-linear Fabry-Perot interferometer, Can, J. Phys, 60: 1303-1310; 1982.

326. Chrostowski, J., Delisle, C., and Tremblay, R. Acousto-optic bistable generator. 1982 Annual Meeting of Optical Society of America, Tucson, AZ. October 19-22, 1982.

327. Lipsett, F.R., and Haycock, A.B. Preparation of personal biographies using a large computing facility. J. Chem. Inf. Comput. Sci. 22(1): 1-4; 1982.

328. Lipsett, F.R. Book review - Laser crystals. Phys. Can. 38(1): 27; 1982.

329. Giguère, L.A., Delâge, A., Dill, L.M., et Gerritsen, J. Predicting encounter rates for zooplankton; a model assuming a cylindrical encounter field. Can. J. Fish. Aquat. Sci. 39(2): 237-242; 1982.

330. Mason, B.F., Caudano, R., and Williams, B.R. The study of order, disorder, nucleation, and energy changes at surfaces using a He beam. J. Phys. Chem. 77(1); 562-569; 1982.

---

* Paper published while author member of Electron Physics Section, but work done elsewhere.

*331. Reddy, B.R., and Venkateswarlu, P. Energy transfer in LaF_3: R^{3+}, Pr^{3+}, (where R = Nd, Dy). J. Chem. Phys. 77(6): 2862-2869; 1982.

332. Szabo, A. Search for the Anderson transition in ruby. Phys. Rev. B, 26(1): 420-422: 1982.

333. Chapman, R., and Hobson, J.P. Solar-powered magnetron pump/gage. J. Vac. Sci. Technol. A1: 133; 1983.

334. Chrostowski, J., Delisle, C., and Tremblay, R. Optical oscillations in an acousto-optic bistable device. Can. J. Phys. 61: 189-191; 1983.

335. Chrostowski, J., Valee, R., and Delisle, C. Self-pulsing and chaos in acousto-optic bistability. Can. J. Phys. 61: 1143-1148; 1983.

336. Erickson, L.E., and Monnon, R.E. Monochromator-microcomputer interface for photon counting, wavelength readout, and scan control. Rev. Sci. Instrum. 54(6): 701-705; 1983.

337. Hobson, J.P. Limits of vacuum production and measurement. Proc. 9th Int. Vacuum Congress and 5th Int. Conf. on Solid Surfaces, Associacion Espanola del Vacio y sus Aplicaciones, Madrid, Spain. September 29, 1983. p. 35.

338. Lipsett, F.R. New opportunities in space: research in microgravity. Can. Aeronaut. Space J. 29(1): 6-13; 1983. NRC 23935.

339. Mason, B.F., and Williams, B.R. Inelastic atom scattering from layers of atoms and molecules on Cu(110). Surf. Sci. 130(2): 295-315; 1983.

340. Mason, B.F., and Williams, B.R. Inelastic changes during the formation of multilayers of C_2H_6 on Ag(110). Surf. Sci. 130(2): L329-L336; 1983.

341. Mason, B.F., McGreer, K., and Williams, B.R. Inelastic scattering of He atoms from a Cu(110) surface. Surf. Sci. 130(2): 282-294; 1983.

342. Reddy, B.R., and Erickson, L.E. Nuclear-quadrupole-resonance study of the ground state of praseodymium in lanthanum trifluoride. Phys. Rev. B, 27(9): 5217-5223; 1983.

343. Reddy, B.R., and Venkateswarlu, P. Energy up-conversion in LaF_3:Nd^{3+}. J. Chem. Phys. 79(12): 5845-5850; 1983.

344. Szabo, A. Spin dependence of optical dephasing in ruby: the frozen core. Opt. Lett. 8: 486; 1983.

---

* Paper published while author member of Electron Physics Section but work done elsewhere.

345. Szabo, A., and Chrostowski, J. Photon echo modulator in ruby. J. Opt. Soc. Amer. 73: 1391-1392; 1983.

346. Armstrong, R.A., and Hobson, J.P. The contribution of ultrahigh vacuum science to catalysis. Catalysis on the Energy Scene, Studies in Surface Science and Catalysis, Proc. 9th Can. Symp. on Catalysis, Quebec City, P.Q. October 1-3, 1984. (Edited by S. Kaliaguine and A. Mahay). Elsevier. 1984. Vol. 19, pp. 33-43.

347. Delâge, A., and Sewell, P.B. Study of space charge limitation of thermionic cathodes in triode guns. Electron Optical Systems for Microscopy, Microanalysis and Microlithography, Scanning Electron Microscopy Inc. 1984. pp. 171-178.

348. Heber, J., and Szabo, A. Argon pumped dye laser operation in the 690-700 nm region. IEEE J. Quantum Electron. QE-20: 9; 1984.

349. Hobson, J.P. The future of vacuum technology. J. Vac. Sci. Technol. A, 2: 144-149; 1984. Reprinted in "The History of Vacuum Science and Technology". T.E. Madey and W.C. Brown, editors. American Institute of Physics. 1984.

350. Hobson, J.P. Ultrahigh vacuum. Can. Chem. News, 36(6): 12-16; 1984.

351. Hren, J.J., Lenz, F.A., Munro, E., and Sewell, P.B. (Editors). Electron optical systems for microscopy, microanalysis and microlithography, Scanning Electron Microscopy Inc., AMF O'Hare, IL. 1984.

352. Mason, B.F., and Williams, B.R. The scattering of He from adsorbed layers of gases on Ag(110). Surf. Sci. 139(1): 173-184; 1984.

353. Mason, B.F., and Williams, B.R. Dispersion behavior in physisorbed Xe on KCl. Surf. Sci. 148: L686-L690; 1984.

354. Sewell, P.B., and Delâge, A. Thermionic emission studies of microflat single crystal LaB_6 cathodes. In Electron Optical Systems for Microscopy, Microanalysis and Microlithography, Scanning Electron Microscopy Inc. 1984. pp. 163-170.

355. Szabo, A., and Chrostowski, J. Simulated on-axis photon echo modulation in ruby. Proc. Conf. Quantum Optics V. Plenum Press, New York, NY. 1984. pp. 301-308.

356. Szabo, A., and Heber, J. Optically induced homogeneous line narrowing. Phys. Rev. A. 29: 3452-3454; 1984.

357. Shih, I., Champness, C.H., Sewell, P.B., and Ding, L. Autoepitaxy of tellurium using vacuum deposition. J. Cryst. Growth, 70: 523-528; 1984.

*358. Adams, D.L., Moore, W.T., and Mitchell, K.A.R. Multilayer relaxation of the Ni(311) surface: a new LEED analysis. Surf. Sce. 149: 407-422; 1985.

359. Armstrong, R.A., and Egelhoff, W.F., Jr. An analysis of angular dependent XPS/peak intensities. Surf. Sci. 154: L225-L232; 1985. NRC 24727.

360. Chapman, R., and Hobson, J.P. Pumping of methane by a low power hot-cathode ion pump/gage. J. Vac. Sci. Technol. A3(3): 476-478; 1985. NRC 24729.

361. Erickson, L.E. NMR measurement of rare earth ion in an excited state by indirect optical detection. Laser Spectroscopy VII: 287-289: (Springer Series in Optical Sciences), Springer-Verlag, Berlin, 1985.

362. Fontaine, M., and Kornelsen, E.V. The effect of a depth dependent diffusion coefficient on the trapping of mobile particles near a solid surface. Radiat. Eff. 90: 111-125; 1985.

363. Hobson, J.P. L'avenir de la technologie du vide. Le Vide, les couches minces. 40(228)(suppl.): 75-88; 1985.

*364. Hui, K.C., Milne, R.H., Mitchell, K.A.R., Moore, W.T., and Zhou, M.Y. LEED crystallographic investigation of the surface structure designated Zr(0001) - (2×2) - O. Solid State Commun. 56: 83-86; 1985.

365. Moore, W.T., and Kornelsen, E.V. Activation energies and frequency factors for the thermal desorption of He bound at vacancies in Mo. Radiat. Eff. 90: 141-147: 1985.

366. Reddy, B.R. Curve fitting of heterodyne data. Appl. Spectrosc. 29(3): 480-484; 1985. NRC 24728.

367. Sharma, K.K., and Erickson, L.E. Optically detected nuclear magnetic resonance of $LiYF_4:Eu^{3+}$ in the ground electronic state $^7F_0$. J. Phys. C, 18: 2935-2942; 1985. NRC 24636.

368. Reddy, B.R. PET and the Reticon. Interfaces in Computing, 3: 27-35; 1985.

369. Erickson, L.R. NMR measurement of an ion in an excited state by indirect optical detection: A $^1G_4$ level of $LiYF_4:Pr^{3+}$. Phys. Rev. B, 32: 1-5; 1985.

---

* Paper published while author member of Electron Physics Section but work done elsewhere.

370. Dubowski, J.J., Williams, D.F., Sewell, P.B., and Norman, P. Epitaxial growth of (100) CdTe on (100) GaAs induced by pulsed laser evaporation. Appl. Phys. Lett. 46: 1081-1083; 1985.

371. Hobson, J.P., and Chapman, R. The pumping of methane by ST 707 at low temperatures. J. Vac. Sci. Technol. In press.

372. Fontaine, M., Delâge, A., Landheer. D. Modelling of titanium diffusion into $LiNbO_3$ using a depth dependent diffusion coefficient. J. Appl. Phys. In press.

373. Landheer, D., Mitchell, D.F., and Sproule, G.I. SIMS and AUGER study of lithium niobate processing for integrated optics. J. Vac. Sci. Technol. In press.

374. Szabo, A. On-axis photon-echo modulation in ruby. J. Opt. Soc. Am. B, 3: 514-522; 1986.

PART 2: BOOKS AND BOOK CHAPTERS

1. Redhead, P.A. Section on "Electron Tubes" for the Encyclopedia Britannica, 1956.

2. Redhead, P.A., Hobson, J.P. and Kornelsen, E.V. Ultra High Vacuum Advances in Electronics and Electron Physics, Vol. 17, pp. 323-431, 1962.

3. Hobson, J.P. Physical Absorption at Extremely Low Pressures. The Solid-Gas Interface, (edited by E.A. Flood), Vol.1, Chapter 4, pp. 447-489. Marcel Dekker, New York.

4. Hobson, J.P. and Flood, E.A. Simple Kinetic Theory and Accomodation, Reflection and Adsorption of Molecules. In Solid-Gas Interface, (edited by E.A. Flood), Vol.2, Chapter 28, pp. 829-846. Marcel Dekker, New York, 1967.

5. Redhead, P.A., Hobson, J.P. and Kornelsen, E.V. Physical Basis of Ultrahigh Vacuum. Chapman and Hall, London, 498 pages, 1968.

6. Armstrong, R.A. and Hobson, J.P. Physical Adsorption on Metal Surfaces in "Structure and Properties on Metal Surfaces". Edited by Saburo Shimodairo. Published by Honda Memorial Foundation, Tokyo, No.1: 202-245; 1973.

7. Redhead, P.A. Very Low Pressures and Ultra-Low Pressures (Below 10^{-6} Torr), Chapter 4, Part 7, Vol.II - Experimental Thermodynamics of Non-Reacting Fluids. Published by Butterworths, London, 1975 for the International Union of Pure and Applied Chemistry.

8. Armstrong, R.A. Diffraction Methods, in Experimental Methods in Catalytic Research, Vol. III, Characterization of Surfaces and Adsorbed Species, pp. 121-148, 1976. Academic Press Inc., New York.

9. Redhead, P.A., Hobson, J.P. and Kornelsen, E.V. The Physical Basis of Ultrahigh Vacuum. Translated by Drs. G. Tominaga and Y. Tuzi and published in Japanese by Iwami Shoten Publishers, 2-5-5 Hitosubashi Chiyoda-ku, Tokyo, Japan. 543 pages, 1977.

10. Hobson, J.P. Potential Theories: Hobson's theory in "Vacuum Physics" pp. 415-426, by Ben Hui Gao and Shu-Jian Chu, published by Xing Hua Book Store, Beijing, China, 1983. A complete translation into Chinese of two papers by J.P. Hobson, Can. J. Phys. 43: 1934-40 and 1941-50; 1965.

PART 3: PRESENTED PAPERS

Records of presented papers prior to 1956 were not found.

1. Hobson, J.P. The reflection of slow electrons for tantalum and copper. Presented at 16th MIT Conference on Physical Electronics, Boston, Mass. March 1956.

2. Hobson, J.P. and Redhead, P.A. Experiments below 10^{-10} mm Hg using liquid helium. Presented at 17th Physical Electronics Conference, Cambridge, Mass. March 21-23, 1957.

3. Redhead, P.A. A Penning Ionization Gauge for extremely low pressures. Presented at 17th Physical Electronics Conference, Cambridge, Mass. March 21-23, 1957.

4. Hobson. J.P. Chemical and ionic pumping of nitrogen in ultrahigh vacuum systems. Presented at Congress of the Canadian Association of Physicists, McMaster University, Hamilton, Ontario. June 16-18, 1958.

5. Hobson, J.P. and Redhead, P.A. Factors limiting ultimate pressure in ultra-high vacuum systems. Presented at the First International Congress on Vacuum Techniques, Namur, Belgium. June 10-13, 1958.

6. Redhead, P.A. Pressure measurements at ultra-high vacuum (10^{-8} to 10^{-13} mm Hg). Presented at the First International Congress on Vacuum Techniques, Namur, Belgium. June 10-13, 1958.

7. Hobson, J.P. First adsorbed layer of helium. Presented at a meeting of the American Physical Society held at Vancouver, B.C. August 24, 1958.

8. Redhead, P.A. A magnetron gauge for ultra-high vacuum. Presented at the 18th Physical Electronics Conference, Cambridge, Mass. March 27-29, 1958.

9. Redhead, P.A. Progress report on ultra-high vacuum studies. Presented at the Research Center, International Business Machines Corporation, Poughkeepsie, N.Y. May 22, 1958.

10. Redhead, P.A. The production and measurement of ultra-high vacuum (10^{-8} to 10^{-13} mm Hg). Presented at the 5th National Symposium on Vacuum Technology of the American Vacuum Society, San Francisco, California. October 22-24, 1958.

11. Kornelsen, E.V. An ultra-high vacuum mass spectrometer. Presented at the 19th Physical Electronics Conference, held at Massachusetts Institute of Technology, Cambridge, Mass. March 26-28, 1959.

12. Redhead, P.A. Gas analysis of very low pressures. Presented to Department of Electrical Engineering, University of Minnesota, Minneapolis, Minn. 1959.

13. Redhead, P.A. The desorption spectrometer as an analytic tool - ultra-high vacuum investigations. Presented at the 6th National Symposium on Vacuum Technology of the A.V.S., Philadelphia, Pa., 1959.

14. Hobson, J.P. Physical adsorption of nitrogen at very low pressures. Presented at Fifteenth Annual Congress, Canadian Association of Physicists, Kingston, Ontario. June 8, 1960.

15. Redhead, P.A. Errors in measurement of pressure with ionization gauges. Presented at the National Symposium on Vacuum Technology, Cleveland, Ohio. October 12-14, 1960.

16. Redhead, P.A. Adsorption of Carabon Monoxide in tungsten: gap-filling in an immobile film. Presented at 20th Annual Conference on Physical Electronics, Massachusetts Institute of Technology, Cambridge, Mass. 1960.

17. Kornelsen, E.V. A small ionic pump employing metal evaporation. Presented at the National Symposium on Vacuumm Technology, Cleveland, Ohio. October 12-14, 1960.

18. Szabo, A. and Armstrong, R.A. Relaxation in ruby. Presented at American Physical Society, Montreal, Quebec. June 1960.

19. Armstrong, R.A. Paramagnetic resonance: line broadening in ruby. Presented at Royal Society of Canada, Montreal, Quebec. June 1961.

20 Hobson, J.P. and Armstrong, R.A. A study of physical adsorption with ultra-high vacuum techniques. Presented at Twenty-first Annual Conference on Physical Electronics, Cambridge, Mass. March 29-31, 1961.

21. Hobson, J.P. and Armstrong, R.A. Physical adsorption at very low pressures. Presented at the Eighteenth International Congress of Pure and Applied Chemistry, Montreal, Quebec, August 6-12, 1961.

22. Hobson, J.P. Desorption of adsorbed gas and re-emission of gas previously pumped by ionic pumping. Presented at the Second International Vacuum Congress, Washington, D.C. October 16-19, 1961.

23. Hobson, J.P. Physical adsorption in ultra-high vacuum system. Presented at the Second International Vacuum Congress, Washington, D.C., October 16-19, 1961

24. Kendall, B.R.F. A Method of Increasing the Resolving Power of Mass Spectrometers and other Analytic Instruments, Chicago, Illinois, June 1961.

25. Kendall, B.R.F. Sensitive time-off-flight mass spectrometer for gas analysis. Presented at the 9th Annual A.S.T.M. Conference on Mass Spectrometry, Chicago, Illinois. June 1961.

26. Khan, I.H. and Hobson, J.P. Electron reflection and diffraction from tungsten at very low incident energies. Presented at the Congress of the Canadian Association of Physicists, Montreal, Quebec. June 1961.

27. Redhead, P.A. Instrumentation for ultra-high vacuum. Presented at Arnold Air Force Base, Tullahoma, Tenn., March 20, 1961.

28. Redhead, P.A. Chemisorption of gases on metals. Presented at the Defence Research Chemistry Laboratories, Ottawa, Ontario, June 29, 1961.

29. Redhead, P.A. Chemisorption of diatomic gases on tungsten. Presented at Gordon Conference on Chemistry at Interfaces. Meriden, N.H. July 24-28, 1961.

30. Szabo, A. Dynamic nuclear polarization in ruby. Presented at Royal Society of Canada, Montreal, Quebec, June 1961.

31. Szabo, A. Recent advances in masers and lasers. Presented at University of Waterloo Physics Colloquium, October 1961.

32. Armstrong, R.A. Calculations of the integral heat of adsorption of measured adsorption isotherms. Presented at Conference of the Chemical Institue of Canada, Edmonton, Alberta, May 1962.

33. Hobson, J.P. Reflection and diffraction of slow electrons (0 - 100 eV) from single crystals of tungsten. Presented at Department of Physics, Queen's University, Kingston, Ontario. March 20, 1962.

34. Hobson, J.P. A Study of physical adsorption using ultra-high vacuum techniques. Presented at Gordon Research Conference, Meriden, N.H. July 23, 1962.

35. Hobson, J.P. Ultra-high vacuum techniques. Presented at McMaster University, Department of Physics, Hamilton, Ontario, November 22, 1962

36. Hobson, J.P. and Armstrong, R.A. Model for the reflection of slow electrons from single crystals of tungsten. Presented at meeting of

the American Crystallographic Association, Villanova University, Villanova, Pa. June 18-22, 1962.

37. Hobson, J.P. and Khan, I.H. Reflection and Diffraction of Slow Electrons from Single Crystals of Tungsten. Presented at American Physical Society, Washington, D.C. April 1962.

38. Kornelsen, E.V. Penetration of radio active inert gas ions into tungsten and mono-crystals. Presented at an informal Conference on Ranges of Atoms in Solids, Atomic Energy of Canada Ltd., Chalk River, Ontario. September, 1962.

39. Kornelsen, E.V. Entrapment of Inert Gas Ions in Tungsten. Presented to Chemistry Branch of Atomic Energy of Canada, Chalk River, Ontario. December 1962.

40. Robins, J.L. Replacement of Chemisorbed Gases on Tungsten. Presented at American Vacuum Society, Los Angeles, CA. October 1962.

41. Redhead, P.A. Chemisorption, Physisorption and Ionic Entrapment at Clean Surfaces. Presented to General Electric Research Laboratory. Schenectady, NY. May 1962.

42. Redhead, P.A Chemisorption of metals under ultra-high vacuum conditions. Presented at Symposium on Electron Vacuum Physics, Balatonfoldvar, Hungary. September 22, 1962.

43. Szabo, A. and Stoicheff, B.P. Ring structures in ruby laser beams. Presented at URSI, Ottawa, Ontario. October 1962.

44. Edmonds, T. and Hobson, J.P. Reversible adsorption of helium at liquid nitrogen temperatures in an ionization gauge. Presented at Congress of the Canadian Association of Physicists, Laval University, Quebec, Quebec. June 1963.

45. Hobson, J.P. and Armstrong, R.A. A study of physical adsorption at very low pressures using ultra-high vacuum techniques. Presented at the National Colloid Symposium, American Chemical Society, Ottawa, Ontario. June 24-26, 1963.

46. Hobson, J.P. Pumping at solid surfaces. Presented at Conference on Sorption Properties of Vacuum-Deposited Metal Films, Liverpool, England. April 17-19, 1963.

47. Hobons, J.P. Studies of physical adsorption, thermal transportation, and ion surface interactions, using ultra-high vacuum techniques. Presented at General Electric Research Laboratories, Schenectady, NY. September 18, 1963.

48. Redhead, P.A. The ionization of adsorbed oxygen by electron impact. Presented at Surface Physics Colloquium, Pullman, Washington. May 17-18, 1963.

49. Redhead, P.A. Some problems of pressure measurements. Presented at American Vacuum Society Northern California Section, Palo Alto, CA. May 21, 1963.

50. Redhead, P.A. Electron impact ionization of adsorbed gases. Presented at Stanford Research Institute, Stanford, CA. May 28, 1963.

51. Redhead, P.A. Reverse X-ray currents in Bayard-Alpert ionization gauges. Presented at American Vacuum Society Conference, Boston, MA. October 16-18, 1963.

52. Redhead, P.A. Interaction of slow electrons with chemisorbed oxygen. Presented at Physics Seminar, University of Illinois, Urban, I11. November 8, 1963.

53. Szabo, A. Microwave maser action in ruby at 78°K by laser pumping. Presented at Brooklyn Polytechnic Symposium in Optical Masers, Brooklyn, NY. April 1963.

54. Szabo, A. Optical maser theory. Presented at Optical maser seminars. NRC Ottawa, Ontario. September 1963.

55. Wightman, B.A. The quadrupole mass filter. Presented at Annual Conference on the Chemical Institute of Canada, Toronto, Ontario. June 1963.

56. Hobson, J.P. Measurements with a modulated Bayard-Alpert gauge in aluminosilicate glass at pressures below 10^{-12} Torr. Presented at the 24th Annual Conference on Physical Electronics, Massachusetts Institute of Technology, Cambridge, MA. March 25-27, 1964.

57. Hobson, J.P. Model for calculation of physical adsorption isotherms on a heterogeneous surface at very low pressures. Presented at the Annual Congress of the Canadian Association of Physicists, Halifax, N.S. June 10-13, 1964.

58. Hobson, J.P. and Redhead, P.A. Low pressure limits of hot filament ionization gauges. Presented at 11th National Symposium of the American Vacuum Society, Chicago, Ill. September 29 to October 2, 1964.

59. Hobson, J.P. Physical adsorption at very low pressures. Presented at Physical Colloquium, Queen's University, Kingston, Ontario. December 16, 1964.

60. Kornelsen, E.V. Penetration of inert gas ions into tungsten single crystals. Presented at Surface Physics Symposium, Pullman, Wash. May 8-9, 1964.

61. Kornelsen, E.V. Recent surface studies using ultra-high vacuum techniques. Presented at Field Emission Corporation, Linfield, Oreg. May 11, 1964: Stanford, California, May 12, 1964.

62. Redhead, P.A. Interaction of slow electrons with chemisorbed gases. Presented at Annual Sherwood Conference, Washington, D.C. January 30-31, 1964.

63. Redhead, P.A. Experiments in ultra-high vacuum. Presented at American Vacuum Society, Hampton, Va. June 3, 1964.

64. Redhead, P.A. and Hobson, J.P. Total pressure measurements below 10^{-10} Torr with non-magnetic ionization gauges. Presented at Conference on Fundamental Problems of Low Pressure Measurements, Teddington, England. September 23-25, 1964.

65. Redhead, P.A. Electronic Desorption of Chemisorbed layers. Presented at Minneapolis-Honeywell Research Center, Minneapolis, Minn. April 1964.

66. Redhead, P.A. Experiments in Ultra-high Vacuum. Presented at American Vacuum Society, Washington, D.C. Section, June 1964.

67. Szabo, A. and Stein, R.A. Theory of laser giant pulsing by a saturable absorber. Presented at American Physical Society, Chicago, Ill. October 1964.

68. Wightman, B.A. An ultrahigh vacuum monopole mass spectrometer. Presented at American Vacuum Society, Chicago, Ill. September 1964.

69. Armstrong, R.A. Surface potential of carbon monoxide on tungsten (211) crystal. Presented at Physical Electronics Conference, Massachusetts Institute of Technology, Cambridge, Mass. March 1965.

70. Armstrong, R.A. Inelastic reflection of slow electrons from single crystals of tungsten. Presented at Congress Canadian Association of Physicists, Vancouver, B.C. 1965.

71. Edmonds, T. and Hobson, J.P. A study of thermal transpiration using ultra-high vacuum techniques. Presented at III International Vacuum Congress, Stuttgart, Germany. June 8 - July 2, 1965.

72. Hobson, J.P. Physical adsorption at very low pressures. Presented at the Department of Electrical Engineering Colloquium, University of Minnesota, Minn. January 21, 1965.

73. Hobson, J.P. Physical adsorption isotherms at very low pressures. Presented at 149th Annual Meeting of the American Chemical Society, Detroit, Mich. April 7, 1965. (Kendall Award Symposium)

74. Hobson, J.P. Van der Waal's interaction of gases with surfaces at very low coverages. Presented at Gordon Research Conference on Chemistry at Interfaces, Meriden, N.H. July 27, 1965.

75. Hobson, J.P. Theoretical isotherms for physical adsorption at pressures below 10^{-10} torr. Presented at 12th National Symposium of the American Vacuum Society New York, N.Y. September 28 - October 1, 1965.

76. Kornelsen, E.V. Developments in the measurement of low pressures. Presented at the Third International Vacuum Congress, Stuttgart, Germany. June 8 to July 2, 1965.

77. Redhead, P.A. Advances in ultra-high vacuum measurements. Presented to Laboratory Colloquium, RCA Laboratories, Princeton, N.J. March 17, 1965.

78. Redhead, P.A. Extremely low pressures, production, measurement and significance. Presented at Conference on Advances in Vacuum Science and Technology, Princeton, N.J. March 18-19, 1965.

79. Redhead, P.A. Vacuum gauging. Presented at Varian Vacuum Seminar, Pala Alto, Calif. April 19-21, 1965.

80. Redhead, P.A. Electronic desorption: a new tool in surface studies. Presented at National Bureau of Standards, Washington, D.C. May 19, 1965.

81. Redhead, P.A. The electronic desorption of chemisorbed molecules. Presented at the 48th Chemical Conference of the Chemical Institute of Canada, Montreal, Quebec. May 30 - June 2, 1965.

82. Rigby, L.J. Interactions of reactive gases on polycrystalline tungsten filaments. Presented at Chemical Institute of Canada, Montreal, Quebec. June 1965. (paper presented by R.A. Armstrong).

83. Szabo, A. and Igarashi, T. Simultaneous ESR and laser action in ruby. Presented in IEEE International Electro Devices Meeting, Washington, D.C. October 1965.

84. Armstrong, R.A. The reflection of slow electrons by hydrogen-covered single crystals of tungsten. Presented at Physical Electronics Conference, Massachusetts Institute of Technology, Cambridge, Mass. March 1966.

85. Erickson, L.E. and Szabo, A. Effects of saturable absorber lifetime on the performance of giant pulse lasers. Presented at 1966 Summer Meeting of the American Physical Society, Minneapolis, Minn. June 20-22, 1966.

86. Hobson, J.P. Physical adsorption and thermal transpiration at extremely low pressures. Presented at the Department of Chemistry, University of Washington, Seattle, Wash. May 19, 1966; Surface Physics Symposium, Washington State University, Pullman, Wash. May 20, 1966; Stanford Research Institute, Menlo Park, Calif. May 27, 1966.

87. Hobson, J.P. and Earnshaw, J.W. The behavior of background hydrogen below 10^{-10} torr. Presented at the 13th National Vacuum Symposium, San Francisco, Calif. October 26-28, 1966.

88. Kornelsen, E.V. Ultra-high vacuum study of ion impact on metals. Presented to Department of Physics, Queen's University, Kingston, Ontario. March 2, 1966.

89. Redhead, P.A. Multiple impact ionization in neon and argon using a trapped-ion source. Presented at 14th Annual Conference on Mass Spectrometry, Dallas, Tex. May 22-27, 1966.

90. Redhead, P.A. The measurement of very low pressures. Presented at the 13th National Vacuum Symposium, San Francisco, Calif. October 26-28, 1966.

91. Szabo, A. Ground state ESR measurements of ruby during laser action. Presented at 4th International Conference on Quantum Electronics, Phoenix, Ariz. April 1966.

92. Armstrong, R.A. A study of CO adsorption on the Ni(100) crystal surface by low energy electron diffraction. Presented at 2nd Symposium on Catalysis, Canadian Institute of Chemistry, McMaster University, Hamilton, Ont. June 14-16, 1967.

93. Armstrong, R.A. The study of single crystal surfaces using slow electrons. Presented at Conference of the Electrochemical Society, Ottawa, Ont. November 16, 1967.

94. Hobson, J.P. Measurement and theory of physical adsorption isotherms at extremely low pressures. Presented at the Department of Physics, University of Wisconsin, Milwaukee, Wis. January 11, 1967.

95. Hobson, J.P. The measurement of very low pressures. Presented at Conference of the American Physical Society, University of Washington, Seattle, Wash. Sept. 1, 1967.

96. Hobson, J.P. Problems of measuring pressures of CO and H_2 in UHV systems. Presented at American Vacuum Society Conference, Kansas City, Kans. October 24-27, 1967.

97. Kornelsen, E.V. Thermal release of inert gases from tungsten mono-crystals. Presented at Conference on Atomic Collision and Penetration Studies with Energetics (keV) Ion Beams, Chalk River, Ont. September 18-21, 1967.

98. Redhead, P.A. Problems of measurements of very low pressure. Presented at Southwest Section, American Vacuum Society, Los Angeles, Calif. May 1, 1967; Northern California Section, American Vacuum Society, Palo Alto, Calif. May 2, 1967; Pacific Northwest Section, American Vacuum Society, Portland, Oreg. May 5, 1967.

99. Redhead, P.A. Recent advances in pressure measurement. Presented at Seminar, Lawrence Radiation Laboratory, Livermore, Calif. May 4, 1967.

100. Redhead, P.A. Electron-impact desorption of CO from tungsten. Presented at Conference on Sorption-Desorption Phenomena, Italian Physical Society, Rome, Italy. March 14-17, 1967.

101. Redhead, P.A. Electronic Desorption of CO from metals. Physics Department Seminar, Washington State University, Pullman, Wash. May 6, 1967.

102. Redhead, P.A. The measurement of low pressures. Presented at Meeting of Rocky Mountain American Vacuum Society, Denver, Colo.

103. Redhead, P.A. Pressure measurements. Presented at Meeting of Greater New York Chapter, Thin-Film Division American Vacuum Society, Bound Book, N.Y. Sept. 25, 1967.

104. Armstrong, R.A. The interaction of slow electrons with CO adsorbed on Ni(100). Presented at Fourth International Materials Symposium, University of California, Berkeley, Calif. June 19-20, 1968.

105. Erickson, L.E. and Szabo, A. Self-Q-switching of ruby lasers at 77°K. Presented at 1968 International Quantum Electronics Conference, Miami, Fla. May 14-17, 1968.

106. Hobson, J.P. Physical processes in vacuum. Presented at Seminar at Philips Laboratories, Einhhoven, The Netherlands. May 2, 1968.

107. Hobson, J.P. The behavior of surface phases in ultra-high vacuum systems. Presented at Seminar at Centre d'Etudes Nucléaires de Saclay, Gif-sur-Yvette, France. April 29 1968.

108. Hobson, J.P. The behavior of hydrogen in ion sources with hot filaments at very low pressures. Presented at Physics Department Seminar, Queen's University, Kingston, Ont. February 13, 1968.

109. Hobson, J.P. and Earnshaw, J.W. The measurement of hydrogen pressure with a modulated Bayard-Alpert gauge at very low pressures. Presented at 4th International Vacuum Congress, Manchester, England, April 17-19, 1968.

110. Hobson, J.P. and Redhead, P.A. Physical processes in vacuum. Presented at 4th International Vacuum Congress, Manchester, England, April 17-19, 1968.

111. Hobson, J.P. Physical adsorption isotherms covering the pressure range from vapour to ultra-high vacuum. Presented at Symposium on the Interaction of Gases with Solid Surfaces, 156th National Meeting of the American Chemical Society, Atlantic City, N.J. September 10, 1968.

112. Hobson, J.P. Physical adsorption on heterogeneous surfaces at very low pressures. Presented at 25th Annual Adsorption Conference, Amherst College, Mass. October 11, 1968.

113. Hobson, J.P. Surface smoothness in thermal transpiration at very low pressures. Presented at 15th National American Vacuum Society Symposium, Pittsburg, Pa. October 28 - November 1, 1968.

114. Kornelsen, E.V. Ion gun and crystal heating apparatus for ion bombardment studies. Presented at Physical Electronics Conference, Minneapolis, Minn. March 18-20, 1968.

115. Kornelsen, E.V. Entrapment of inert gases in tungsten. Presented at Gordon Conference on Particle-Solid Interactions, Meriden, N.H. July 15-19, 1968.

116. Kornelsen, E.V. Ionic entrapment in tungsten monocrystals: a survey of effects observed in thermal desorption. Presented at 15th National American Vacuum Society Symposium, Pittsburg, Pa. October 28 to November 1, 1968.

117. Redhead, P.A. Gas discharges at low pressures. Presented at Delaware Valley Section, American Vacuum Society, Philadelphia, Pa. January 18, 1968.

118. Redhead, P.A. Pressure measurement. Presented at Portland State College, Corvallis, Oreg. February 16, 1968.

119. Redhead, P.A. Physical processes influencing pressure measurment. Presented at Argonne Laboratories, Chicago, Ill. February 14, 1968.

120. Redhead, P.A. Multiple ionization and excitation by sequential electron impact. Presented at Physics Seminar, University of Southern California, Los Angeles, Calif. February 19, 1968.

121. Redhead, P.A. Electron impact desorption. Presented at Surfcae Physics Symposium, New Mexico Section, American Vacuum Society, Albuquerque, N.Mex. March 14, 1968.

122. Redhead, P.A. The measurement of extremely low pressures. Presented at Mid-Atlantic States Section, American Vacuum Society, Washington, D.C. April 3, 1968.

123. Redhead, P.A. Studies of multiple ionization by ion-trapping methods. Presented at the Annual Meeting of the Royal Society of Canada, Calgary, Alta. June 1-4, 1968.

124. Armstrong, R.A., Gopalaraman, C.P. and Redhead, P.A. Sensitivity variations in Bayard-Alpert Gauges caused by Auger emssion at the collector. Presented at the 16th National Symposium of the American Vacuum Society, Seattle, Wash. October 30, 1969.

125. Armstrong, R.A. Auger and photo-electron spectroscopy. Presented at 2nd Annual Canadian Seminar on Surfaces, Ottawa, Ont. November 24, 1969.

126. Fenton, E.W. Excitonic insulator. Presented at Physics Seminar, NRC, Ottawa, Ont. February 24, 1969.

127. Fenton, E.W. Excitonic insulator. Presented at Physics Department, Waterloo University, Waterloo, Ont. March 5, 1969.

128. Fenton, E.W. Excitonic insulator. Presented at Physics Department, State University of New York, Buffalo, N.Y. April 24, 1969.

129. Fenton, E.W., participant. Seminar series - Fundamental problems in metals. Presented at Theoretical Physics Section, Canadian Association of Physicists, Banff School of Fine Arts, Banff, Alta. August 11-22, 1969.

130. Hobson, J.P. Physical basis of ultra-high vacuum. Presented at Physics Department Colloquium, University of British Columbia, Vancouver, B.C. January 30, 1969.

131. Hobson, J.P. Physical adsorption at extremely low pressures. Presented at Chemistry Department, Case Western Reserve University, Cleveland, Ohio. March 28, 1969.

132. Hobson, J.P. The influence of surfaces on pressure measurements. Presented at Symposium of the New England Section of the American Vacuum Society, Boston, Mass. April 24, 1969.

133. Hobson, J.P. Accommodation pumping - a new principle for low pressures. Presented at 16th National Symposium of the American Vacuum Society, Seattle, Wash. October 30, 1969.

134. Hobson, J.P. Accommodation pumping - a new principle for low pressures. Presented at Science Association Meeting, REED, NRC, Ottawa, Ont. November 19, 1969.

135. Kornelsen, E.V. Entrapment of inert gases in monocrystals of tungsten. Presented at Seminar, Institute for Surface and Coatings Research, Lehigh University, Bethlehem, Pa. February 14, 1969.

136. Kornelsen, E.V. The entrapment of helium at near-surface lattice defects in tungsten. Presented at Institute for Materials Research, McMaster University, Hamilton, Ont. September 29, 1969.

137. Kornelsen, E.V. Adsorption, desorption and ion scattering. Presented at 2nd Annual Canadian Seminar on Surfaces, Ottawa, Ontario. November 24, 1969.

138. Redhead, P.A. Multiple ionization by sequential electron impact; properties of trapped-ion sources. Presented at 4th Conference of Mass Spectrometry Group, Sheffield University, Sheffield, England. September 16-18, 1969.

139. Redhead, P.A. Ion desorption by electron bombardment; relation to total and partial pressure measurements. Presented at 16th National Symposium of the American Vacuum Society, Seattle, Wash. October 29, 1969.

140. Armstrong, R.A. and Redhead, P.A. Techniques for analysis of structure and composition of adsorbed layers. Presented at International Symposium on Surface Physics and Ultrahigh Vacuum Science, University of Groningen, The Netherlands. September 10-11, 1970.

141. Armstrong, R.A. Auger electron energy analysis: a method of measuring the chemical composition of surfaces in ultra-high vacuum. Presented at Seminar Series of the Institute for Materials Research, McMaster University, Hamilton, Ont. December 7, 1970.

142. Fenton, E.W. Magnetic-field-induced semiconductor-semimetal transitions. Presented at Physics Department, State University of New York, Buffalo, N.Y. March 9, 1970.

143. Fenton, E.W. Magnetic-field-induced semiconductor-semimetal transition in Bi-Sb alloys. Presented at Conference of Semimetals and Narrow Gap Semiconductors, Dallas, Tex. March 20, 1970.

144. Hobson, J.P. A demonstration of accommodation pumping - a new principle for low pressures. Presented at Trent University Science Seminar, Peterborough, Ont. March 6, 1970.

145. Hobson, J.P. and Richardson, G.W. Accommodation pumping. Presented at the New England Section of the American Vacuum Society, Waltham, Mass. April 30, 1970.

146. Hobson, J.P. Surface phenomena at low pressures and temperatures. Presented at American Institute of Chemical Engineers, Denver, Colo. August 31, 1970.

147. Hobson, J.P. Analysis of accommodation pumps. Presented at 17th Annual Symposium of the American Vacuum Society, Washington, D.C. October 21, 1970.

148. Hobson, J.P. Cryopumping. Course for Vacuum Technicians. Presented at 17th Annual Symposium of the American vacuum Society, Washington, D.C. Oct. 21, 1970.

149. Redhead, P.A. Energy levels of positive ions by trapped-ion mass spectrometry. Presented at University of Western Ontario, London, Ont. March 5, 1970.

150. Szabo, A. Laser-induced fluorescence line narrowing in ruby. Presented at International Quantum Electronics Conference, Kyoto, Japan. September 7-10, 1970; Radio Research Laboratory, Tokyo, Japan. September 17, 1970; Japan Science Promotion Society, University of Tokyo, Tokyo, Japan. October 27, 1970.

151. Szabo, A. Self-Q-Switching in ruby lasers. Presented at Association for Electronic Engineering Studies, Quantum Electronics Group, Tohoku University, Sendai, Japan. October 19, 1970.

152. Szabo, A. Tunable dye lasers. Presented at Japan Spectroscopic Company, Tokyo, Japan. October 26, 1970; Nippon Electric Central Research Laboratory, Tokyo, Japan. October 28, 1970; Hitachi Central Research Laboratory, Tokyo, Japan. October 29, 1970; Mitsubishi Research Laboratory, Kamakura City, October 31, 1970; Yamagata University, Yonezawa, November 11, 1970.

153. Szabo, A. Optical Pumping of ruby by laser resonance radiation: application to microwave and optical masers. Presented at Association for Electronic Engineering Studies, Microwave Group, Tohoku University, Sendai, Japan. November 6, 1970.

154. Szabo. A. A new theory of CW dye laser action. Presented at Institute of Electrical Communication, Quantum Electronics Group Seminar, Tohoku University, Sendai, Japan. November 21, 1970.

155. Szabo, A. Do photons exist? Presented at Institute of Electrical Communications, Quantum Electronics Group Seminar, Tohoku University, Sendai, Japan. November 23, 1970.

156. Armstrong. R.A. Electron spectroscopy in surface studies. Presented at Spectroscopy Society of Canada, Ottawa, Ont. February 11, 1971.

157. Armstrong, R.A. La physique des surfaces au C.N.R.C. Présenté au séminaire de physique des surfaces, Centre d'études nucléaires de Saclay, France. 28 mai 1971.

158. Armstrong, R.A. A review of experimental results related to physical absorption on metals. Presented at Vacuum Group. The Institute of Physics, London, England. June 23, 1971.

159. Hobson, J.P. and Chapman, R. The onset of Henry's law for physical adsorption of a vapor on a heterogeneous surface. presented at the 2nd International Conference on Adsorption-Desorption Phenomena, Florence, Italy. April 14, 1971.

160. Hobson, J.P. Accommodation pumping. Presented at Centre d'études nucléaires de Saclay, France. April 22, 1971.

161. Hobson, J.P. Design parameters of accommodation pumps. Presented at 1st Annual Conference on Vacuum Equipment, Institute of Physics and the Physical Society, University of Sussex, Sussex, England. April 5, 1971.

162. Hobson, J.P. and Pye, A.W. Physical factors influencing accommodation pumps. Presented at 5th International Vacuum Congress, Boston, Mass. October 13, 1971.

163. Kornelsen, E.V. Entrapment of helium at vacancies in a (100) tungsten crystal. Presented at International Conference on Solid Surfaces, Boston, Mass. October 11-15, 1971.

164. Kornelsen, E.V. Interaction of injected helium with lattice defects in tungsten crystal. Presented at International Conference on Atomic Collisions in Solids, Gausdal, Norway, September 20-24, 1971; Department of Electrical Engineering, University of Salford, Salford, U.K. September 30, 1971; Sandia Corporation, Albuquerque, N.M. December 6, 1971; Sandia Corporation, Livermore, Calif. December 8, 1971; Department of Physics, Washington State University, Washington, D.C. December 9, 1971.

165. Szabo, A. CW laser-induced fluorescence line-narrowing in ruby: Zeeman studies. Presented at Canadian Association of Physicists Congress, Ottawa, Ont. June 22-25, 1971.

166. Szabo, A. Laser induced fluorescence line narrowing in ruby. Presented at Radiation Laboratory Seminar, Columbia University, New York, N.Y. October 22, 1971; Physics Seminar, University of Toronto, Toronto, Ont. November 11, 1971.

167. Szabo, A. Optical analog of the Mössbauer effect. Presented at Physical Seminar, University of Waterloo, Waterloo, Ont. November 12, 1971.

168. Fenton, E.W. Magnetic field dependence of Kondo alloys. Presented at Canadian Association of Physics, Annual Conference, Edmonton, Alta. June 26, 1972.

169. Hobson, J.P. Pompage cryogénique - une synthèse. Presented at Annual Conference Vacuum Engineers and Technicians, Versailles, France. May 31, 1972 (given in French)

170. Hobson, J.P. Survey of modern methods for surface analysis. Presented at Physic Colloquium, University of Western Ontario, London, Ont. Feb. 2 1972

171. Hobson, J.P. Cryopumping. Presented at 19th Symposium of the American Vacuum Society, Chicago, Ill. October 3, 1972.

172. Hobson, J.P., Baker, B.G. and Pye A.W. Further measurements of physical factors influencing accommodation pumps. Presented at 19th Symposium of the American Vacuum Society. October 5, 1972.

173. Hobson, J.P. Pressure measurement in vacuum systems at variable temperatures. Presented at Brookhaven National Laboratory, Upton, N.Y. Sept. 15, 1972.

174. Kornelsen, E.V. Ultrahigh vacuum technology and its application to the study of radiation damage in metals. Presented at Physics Department, Trent University, Peterborough, Ont. January 7, 1972.

175. Kornelsen, E.V. Thermal stability of inert gas in metal. Presented at NASA Research Centre, Langley, Va. September 20, 1972.

176. Kornelsen, E.V. Entrapment of helium at vacant lattice sites in tungsten. Presented at Metal Physics Division, Oak Ridge National Laboratories, Oak Ridge, Tenn. January 25, 1972.

177. Kornelsen, E.V. Damage created near a tungsten crystal surface by pulsed laser radiation. Presented at Solid State Science Branch, Chalk River Nuclear Laboratories, Chalk River, Ont. June 6, 1972.

178. Szabo, A. Laser induced fluorescence line narrowing in ruby and iodine. Presented at Laser-Plasma Physics Seminar, NRC, Ottawa, Ont. February 8, 1972.

179. Szabo, A. Laser induced fluorescence line narrowing. Presented at VII International Quantum Electronics Conference, Montreal, P.Q. May 8-11, 1972.

180. Armstrong, R.A. The adsorption of methane on titanium films studied by Auger electron spectroscopy. Presented at Fourth Canadian Seminar on Surfaces, Atomic Energy of Canada Ltd., Chalk River Nuclear Laboratories, Chalk River, Ont. June 10-12, 1973.

181. Armstrong, R.A. A study of nickel films on pyrex by auger electron spectroscopy. Presented at the 56th Annual Conference of the Chemical Institute of Canada, Montreal, P.Q. June 4-8, 1973.

182. Hobson, J.P. Physical adsorption. Presented at International Summer Institute in Surface Science, University of Wisconsin, Milwaukee, Wisc. August 29, 1973.

183. Hobson, J.P. Ultra-high vacuum and the solid-gas interface. Presented at the 47th National Colloid Symposium, Carleton University, Ottawa, Ont. June 19, 1973.

184. Kornelsen, E.V. and Edwards, D.E. Jr. Interaction of He with a Ni(100) crystal. Presented at Fourth Canadian Seminar on Surfaces, Atomic Energy of Canada Ltd., Chalk River Nuclear Laboratories, Chalk River, Ont. June 10-12, 1973.

185. Kornelsen, E.V. and Edwards, D.E. Jr. Observation of ion bombardment damage in a Ni(100) crystal by helium ion injection. Presented at the International Conference on the Application of Ion Beams to Metals, Albuquerque, N. Mex. Oct. 2-4, 1973.

186. Kornelsen, E.V. Production of point defects in tungsten by Q-switching laser pulse. Presented at University of California, 33rd Physical Electronics Conference, Berkeley, Calif. March 26-28, 1973.

187. Armstrong, R.A. A study of titanium films by Auger electron spectroscopy. Presented at the International Symposium on Characterization of Adsorbed Species in Catalytic Reactions, Unversity of Ottawa, Ottawa, Ont. June 17-20, 1974.

188. Armstrong, R.A. Génération du méthane dans les pompes à titane. Présenté aux Journées de technologie du vide, Versailles, France. 12 juin 1974.

189. Armstrong, R.A. A study of adsorption on titanium films using a molecular beam of active gas and Auger electron spectroscopy. Presented at Physikalisch-Chemisches Institut der Universitat, Munchen. June 5, 1974.

190. Armstrong, R.A. Adsorption sur des couches de titane étudiées par spectroscopie Auger. Présenté au Centre du Cinétique physique et chimique, CNRS, Villers-Nancy, France. 31 mai 1974.

191. Armstrong, R.A. Adsorption sur des couches de titane étudiées par spectroscopie Auger. Présenté au Centre d'études nucléaires de Saclay, France. 10 juin 1974.

192. Edwards, D.E., Jr. Thermal desorption of implanted inert gas ions from nickel. Presented at the 21st National Symposium, American Vacuum Society, Anaheim, Calif. October 8-11, 1974.

193. Hobson, J.P. The relationship of solid surfaces to vacuum science and technology. Presented at 6th International Vacuum Congress, Kyoto, Japan. March 25-29, 1974.

194. Hobson, J.P. Accommodation pumping. Presented at Thin Films and Surface Physics Division of the Japan Society of Applied Physics, Tokyo, Japan. April 5, 1974.

195. Hobson, J.P. Vacuum and surface physics research in the Electron Physics Section, NRC. Presented at Gakushuin University, Tokyo, Japan. April 9, 1974.

196. Hobson, J.P. Survey of ultra-high vacuum instruments for surface studies. Presented at International Symposium Characterization of Adsorbed Species in Catalytic Reactions, University of Ottawa, Ottawa, Ont. June 17-20, 1974.

197. Hobson, J.P. Measurements in ultra-high vacuum. Presented to the American Vacuum Society, Delaware Valley Chapter, Fort Washington, Pa. September 19, 1974.

198. Hobson, J.P. The relationship of solid surfaces to vacuum science and technology. Presented at the RCA Laboratories, Princeton, N.J. September 20, 1974.

199. Kornelsen, E.V. Interaction of helium with vacancies in tungsten and nickel. Presented at Bell Telephone Laboratories, Murray Hill, N.J. January 15, 1974.

200. Szabo, A. Sideband detection of optical hole burning in ruby. Presented at VIII International Quantum Electronics Conference. San Francisco, Calif. June 10-13, 1974.

201. Williams, B.R. The scattering of He atoms from NaF. Presented at 2nd International Conference on Solid Surfaces, Kyoto, Japan. March 25-29, 1974.

202. Hobson, J.P. and Kornelsen, E.V. A target transfer system at ultra-high vacuum. Presented at 5th Canadian Seminar in Surfaces, Laval University, Ste-Foy, P.Q. June 1975.

203. Hobson, J.P. Report of vacuum study group. Isabelle Summer Study, Brookhaven National Laboratory, Long Island, USA. July 14-15, 1975.

204. Takeuchi, N. Photon echo excited by a nitrogen pumped dye laser. Presented at the 22nd General Meeting of the Japan Society of Applied Physics, Tokyo, Japan. April 1-14, 1975,

205. Takeuchi, N. Measurement of relaxation time of $LaF_3:Pr^{3+}$ by photon echo. Presented at International Conference on Luminescence, Tokyo, Japan. September 1-5, 1975.

206. Williams, B.R. Scattering of neutral atoms from surfaces in ultra-high vacuum. Presented at Physic Department, University of Waterloo, Waterloo, Ont. November 21, 1975.

207. Chapman, R. The electronic devices of the target transfer system. Presented at One-day Seminar on Vacuum Transfer Device, Division of Electrical Engineering, National Research Council, Ottawa, Ont. November 5, 1976.

208. Hobson, J.P. A target transfer system at ultra-high vacuum. Presented at One-day Seminar on Vacuum Transfer Device, Division of Electrical Engineering, National Research Council, Ottawa, Ont. November 5, 1976.

209. Kornelsen, E.V. Helium trapping in cobalt/gallium alloy. Presented at Seminar to Radiation Group, Inter-University Reactor Institute, Delft, The Netherlands. September 9, 1976.

210. Kornelsen, E.V. Potential of helium trapping for the study of defects in metals. Presented to Radiation Damage Groups Working Meeting at Mol, Belgium. October 8, 1976.

211. Kornelsen, E.V. Measurement of vacancy concentration near metal surfaces by helium ion injection. Presented at Colloquium: Technical Physics Dept., Technical University of Delft, The Netherlands. October 11, 1976.

212. Kornelsen, E.V. Trapping of helium in vacancies and vacancy-impurity complexes in tungsten. Presented at Colloquium: University of Groningen, The Netherlands. October 21, 1976.

213. Kornelsen, E.V. Multiple trapping of helium at vacancy-containing defects in tungsten and nickel. Presented at Seminar, Phillips Research Laboratories, Eindhoven, The Netherlands. October 26, 1976.

214. Kornelsen, E.V. Helium trapping at vacancies in tungsten and nickel and the trap mutation effects. Presented at Seminar Max Plank Institute for Plasma Physics, Garding, West Germany. November 2, 1976.

215. Moore, S.E. The scientific uses of the VTD. Presented at One-day Seminar, Division of Electrical Engineering, National Research Council, Ottawa, Ont. November 5, 1976.

216. Szabo, A. and Kroll, M. Electric field induced shifting of optical holes - fluorescence line narrowing and free induction decay in ruby. Presented at IX International Quantum Electronic Conference, Amsterdam, The Netherlands. June 14-16, 1976.

217. Szabo, A. Optical homogeneous linewidths in solids. Presented at Hungarian Academy of Sciences, Budapest, Hungary. June 22, 1976.

218. Szabo, A. Optical homogeneous linewidths in solids. Presented at University of Groningen, The Netherlands. June 24, 1976.

219. Williams, B.R. Brief survey of the capabilities of the molecular beam technique applied to surface studies. Presented at University of Wales, Aberystwyth, Great Britain. June 3, 1976.

220. Armstrong, R.A. A study of evaporated films of titanium and molybdenum by Auger electron spectroscopy. Presented at VI Canadian Seminar on Surfaces, Kingston, Ont. June 6-7, 1977.

221. Armstrong, R.A. L'étude des couches minces de titane et de molydbène. Colloque de Chimie et Physique. C.R.A.M. Université de Laval, Québec (Qué.). 6 décembre 1977.

222. Erickson, L.E. The nuclear quadrupole interaction in $Pr^{3+}:LaF_3$ - an optical RF double resonance measurement of the ground electronic state. Presented at Physics Dept., University of Wisconsin, Madison, Wis. February 11, 1977. (informal talk)

223. Erickson, L.E. The nuclear quadrupole interaction in $Pr^{3+}:LaF_3$ - an optical RF double resonance measurement of the ground electronic state. Presented at Annual Meeting of the American Physical Society, Chicago, I11. February 9, 1977.

224. Erickson, L.E. A measurement of the hyperfine splittings of the $^1D_2$ metastable state of Pr^{3+} in LaF_3 by enhanced and saturated adsorption spectroscopy. Presented at 3rd Specialized Colloque

Ampere, Optical Techniques in Magnetic Resonance Spectroscopy, Trinity College, Dublin, Ireland. August 29, 1977.

225. Hobson, J.P. A target transfer system at ultra-high vacuum. Presented at NRC Science Association Meeting, Ottawa, Ont. March 9, 1977.

226. Hobson, J.P. A target transfer system at ultra-high vacuum. Presented at Physics Dept., University of Washington, Seattle, Wash. May 13, 1977.

227. Hobson, J.P. A Target Transfer System at Ultra-high Vacuum. Presented at VI Canadian Seminar on Surfaces, Queen's University, Kingston, Ont. June 6-7, 1977.

228. Hobson, J.P. and Kornelsen, E.V. A target transfer system at ultra-high vacuum. Presented at 7th International Vacuum Congress and 3rd International Conference on Solid Surfaces, Vienna, Austria. September 15, 1977.

229. Hobson, J.P. Un système à transfert d'une cible à l'ultravide. Présenté à l'Institut national de la recherche scientifique. Université du Québec, Varennes (Qué.). 17 août 1977.

230. Hobson, J.P. First intercontinental test of vacuum transfer device. Presented at 24th National Symposium of the American Vacuum Society, Boston, Mass. November 9, 1977.

231. Hobson, J.P. Methods of Improving Vacuum in Space. Presented at Space Shuttle Symposium. Ames Research Centre, Moffett Field, Calif. May 9-11, 1977.

232. Hobson, J.P. Un SAS pour le transfert d'échantillon en ultravide. Colloque de Chimie et Physique, C.R.A.M., Université de Laval, Québec (Qué.). 6 décembre 1977.

233. Sewell, P.B. A source imaging detector for the scanning electron microscope. Presented at 10th Annual SEM Symposium, The Cormick Inn, Chicago, I11. March 29, 1977.

234. Szabo, A. Optical homogeneous linewidths in solids. Presented at Physics Colloquium, University of Wisconsin, Madison, Wisc. March 18, 1977

235. Erickson, L.E. Ultra-high resolution spectroscopy of ions in insulating solids - a measurement of excited state hyperfine structures. Presented at Department of Physics, Erindale College, Mississauga, Ont. March 7, 1978.

236. Hobson, J.P. The surface science program in the Electron Physics Section at the National Research Council. Presented to the Physics Department, University of Manitoba, Winnipeg, Man. January 24, 1978.

237. Hobson, J.P. Application of a vacuum transfer device for exchange of surface standards. Presented at the Analytical Chemistry and Applied Spectroscopy Conference, Cleveland, Ohio. February 28, 1978.

238. Hobson, J.P. Un système de transfert de cibles dans un vide très poussé. Présenté au 46e congrès de l'association canadienne-française pour l'avancement des sciences, Université d'Ottawa, Ottawa (Ont.). 11 mai 1978.

239. Hobson, J.P. An ultra-high vacuum target transfer device. Presented at TRIUMF Accelerator, University of British Columbia, Vancouver, B.C. May 16, 1978.

240. Hobson, J.P. On minimizing outgassing from the wake shield. Presented at NASA Workshop, Marshall Space Flight Center, Huntsville, Ala. June 12-13, 1978.

241. Hobson, J.P. UHV technique for intervacuum sample transfer. Presented at 25th National Vacuum Symposium, American Vacuum Society, San Francisco, Calif. November 30, 1978.

242. Kornelsen, E.V. Helium binding to defects and impurities in metals. Presented at Cornell University, Ithaca, N.Y. March 16, 1978.

243. Sewell, P.B. Grid aperture contamination in electron guns using directly heated lanthanum hexaboride sources. Presented at SEM Conference, Los Angeles, Calif. April 18, 1978.

244. Szabo A. Optical hole burning in ruby. IBM Research Laboratory Colloquium, San Jose, Calif. October 16, 1978.

245. Szabo A., Muramoto, T., and Kroll, M. Optical hole burning of the ruby R line. Conference Dynamical Processes in the Excited States of Ions and Molecules in Solids, University of Georgia, Athens, Ga. June 2-3, 1978. (Invited)

246. Williams, B.R. Neutral atom scattering from surfaces. NRC Physics Colloquium, Ottawa, Ont. January 6, 1978.

247. van Gorkum, A. Theory of trapping of diffusing particles at defects and impurities near a crystal surface; applications to thermal desorption experiments. NRC/DEE Science Association Meeting, Ottawa, Ont. September 13, 1978.

248. Armstrong, R.A. A study of CO and molybdenum-covered CO on Mo(100) by AES and RHEED. 7th Canadian Seminar on Surfaces, Pinawa, Man. June 13, 1979.

249. Delâge, A. Étude d'émetteurs thermioniques de très grande luminosité. 47^{e} Congrès de l'association canadienne-française pour l'avancement des sciences, Montréal (Qué.). 10 mai 1979.

250. DeVoe, R.G., Szabo, A., Rand, S.C., and Brewer, R.G. Ultraslow optical dephasing of Pr:LaF. 4th International Conference Laser Spectroscopy, Rottach-Egern, Germany. June 11-15, 1979.

251. Erickson, L.E. Ultra-high resolution spectroscopy of ions in insulating solids-a measure of excited state hyperfine structures. Department of Physics, Erindale College, Mississauga, Ont. March 7, 1979.

252. Hobson, J.P. and Cottee, R.D. The use of glass in ultra-high vacuum systems. 24th National Symposium, American Scientific Glassblowers Society, Detroit, Mich. June 26, 1979.

253. Hooson, J.P. et Armstrong, R.A. Réseau de transfert de cibles sous ultravide: une occasion canadienne. 47^{e} Congrès de l'association canadienne-française pour l'avancement des sciences, Montréal (Qué.). 10 mai, 1979.

254. Hobson, J.P. Performance of a combined magnetron pump-gauge at ultra-high vacuum. 7th Canadian Seminar on Surfaces, Pinawa, Man. June 13, 1979.

255. Kornelsen, E.V. and van Gorkum, A.A. Multiple trapping of helium at inert gas impurities in tungsten. 7th Canadian Seminar on Surfaces, Pinawa, Man. June 11, 1979.

256. Kornelsen, E.V. Multiple trapping of He at point impurities in tungsten. Department of Chemical Physics, University of Western Ontario, London, Ont. February 9, 1979.

257. Szabo, A. Frequency and time domain high resolution laser spectroscopy of ions in solids. Physics Colloquium, University of Toronto, Toronto, Ont. February 27, 1979.

258. Szabo, A., DeVoe, R., Rand, S., and Brewer, R.G. Long optical dephasing times in $Pr^{3+}:LaF_3$. Paper J010, American Physical Society, Chicago, Ill. March 19-23, 1979.

259. van Gorkum, A.A. and Kornelsen, E.V. Enhanced penetration of low energy (25 eV - 5000 eV) helium along the 100 channel in tungsten. 8th International Conference on Atomic Collisions in Solids, McMaster University, Hamilton, Ont. August 17, 1979.

260. Armstrong, R.A. La recherche dans la section physique électronique du CNRC. Seminaire, Interactions Gas-Solide du C.E.N., Saclay, France. Septembre 1980.

261. Armstrong, R.A. The dissociation and solution of carbon monoxide at the Mo(100) surface. 8th International Vacuum Congress, 4th International Conference on Solid Surfaces and 3rd European Conference on Surface Science, Cannes, France. September 1980.

262. Delâge, A. Effet du champ local sur les caractéristiques d'émission du canon triode. 48^{e} Congrès de l'association canadienne-française pour l'avancement des sciences, Québec (Qué.). 14-16 mai 1980.

263. Delâge, A. High brightness electron source with LaB cathode. NRC/DEE Science Association, Ottawa, Ont. May 28, 1980.

264. Hobson, J.P. NRC's Electrical Engineering Division and Canadian industry projects. Electrical Engineering Seminar, University of Ottawa, Ottawa, Ont. March 27, 1980.

265. Hobson, J.P. The work of the Electrical Engineering Division of NRC. Colloquium of the Division of Physics, NRC, Ottawa, Ont. February 8, 1980.

266. Jessop, P.E. and Szabo, A. Search for the Anderson transition in ruby. 11th International Quantum Electronics Conference, Boston, Mass. June 23-25, 1980.

267. Kornelsen, E.V. and van Gorkum, A.A. Directional effects in the penetration of Ne, Ar, Kr and Xe into W(100) from the penetration threshold to 10 keV. Gordon Conference on Particle-Solid Interactions, Andover, N.H. July 21-25, 1980.

268. Kornelsen, E.V. Quantitative thermal desorption spectrometry of inert gases. Physics Colloquium, University of Guelph, Guelph, Ont. January 15, 1980.

269. Kornelson, E.V. Ultra-high vacuum system and detector requirements for thermal desorption spectrometry (TDS). American Vacuum Society, Boston, Mass. November 19, 1980.

270. Sewell, P.B. High brightness thermionic guns for electron microscopes. Tutorial presented at the Scanning Electron Microscopy Conference 1980, Chicago, Ill. April 21-25, 1980.

271. Szabo, A. High resolution time and frequency domain spectroscopy of solid state laser materials. International Conference on Lasers '80, New Orleans, La. December 15, 1980.

272. van Gorkum, A.A. and Kornelsen, E.V. The entrance probability and range of helium in W(100) for energies 8 eV to 5000 eV as measured by thermal desorption spectrometry. 8th International Vacuum Congress, 4th International Conference on Solid Surfaces and 3rd European Conference on Surface Science, Cannes, France, September 1980. (Talk presented by R.A. Armstrong)

273. Armstrong, R.A. A review of surface characterization techniques in surface science. NRC/DEE Science Association, Ottawa, Ont. October 14, 1981.

274. Caudano, R. and Williams, B.R. Elastic and inelastic atom scattering from surfaces. Meeting on Surface Physics, Lille, France. November 9-10, 1981.

275. Delâge, A. and Sewell, P.B. Méthode des densités de charges superficielles appliquée à un canon triode à symétrie cylindrique. 49^{e} Congrès de l'association canadienne-française pour l'avancement des sciences, Sherbrooke (Qué.). Mai 1981.

276. Delâge, A. Solution de quelques problèmes d'électrostatique par la méthode des densités de charge. Centre de Recherches sur les Atomes et les Molécules (CRAM), Université Laval, Québec (Qué.). 4 août, 1981.

277. Erickson, L.E. and Sharma, K.K. Hyperfine studies of rare earth ions dilute in optical solids. 5th International Conference on Laser Spectroscopy, Jasper, Alta. June 29-July 3, 1981.

278. Hobson, J.P. An ultra-high vacuum sample transfer device. 10th Annual Symposium, Florida Chapter, American Vacuum Society, Tampa, FL. February 10, 1981.

279. Hobson, J.P. An ultra-high vacuum transfer device. Seminar, New Mexico Chapter, American Vacuum Society, Albuquerque, NM. April 28-30, 1981.

280. Hobson, J.P. Ion gauges. Tennessee Valley Chapter, American Vacuum Society, Oak Ridge, TN. September 22, 1981.

281. Hobson, J.P. Surface science in the Electron Physics Section of NRC. Catalysis Discussion Group Meeting, Carleton University, Ottawa, Ont. May 12, 1981.

282. Hobson, J.P. Vacuum physics in the 1980's. Oak Ridge National Laboratory, Oak Ridge, TN. September 23, 1981.

283. Hobson, J.P. Vacuum physics in the 1980's. Physics Dept., Pennsylvania State University, State College, PA. March 12, 1981.

284. Jessop, P.E. and Szabo, A. High resolution studies of optical saturation in ruby. Conference on Dynamical Processes in Excited States of Ions and Molecules in Solids. Regensburg, F.R.G. July 29-31, 1981.

285. Jessop, P.E. High resolution laser spectroscopy. NRC/DEE Science Association, Ottawa, Ont. March 18, 1981.

286. Sewell, P.B. The application of electron channeling to the study of crystal surfaces. NRC/DEE Science Association, Ottawa, Ont. May 27, 1981.

287. Sharma, K.K. and Erickson, L.E. Coupled transitions in $LiYF_4:Pr^{3+}$. American Physical Society, New York, NY. January 26-29, 1981.

288. Szabo, A. Optical hole burning and ground state energy transfer in ruby. 5th International Conference on Laser Spectroscopy, Jasper, Alta. June 29-July 3, 1981.

289. Armstrong, R.A. Incidence dependent Auger electron production. 42nd Annual Conference Phys. Electron., Georgia Institute of Technology, Atlanta, GA. June 14-16, 1982.

290. Armstrong, R.A. Incidence dependent Auger electron production. 8th Canadian Seminar on Surfaces, Guelph, Ont. June 2-4, 1982.

291. Delâge, A. et Sewell, P.B. Étude de l'optique électronique d'un évaporateur chauffé par bombardement d'électrons. 50^{e} Congrès de l'association canadienne-française pour l'avancement des sciences, UQAM, Montréal (Qué.). Mai 1982.

292. Hobson, J.P. Current projects in the electron physics section of NRC. Institute for Industial Science, University of Tokyo, Tokyo, Japan. October 18, 1982.

293. Hobson, J.P. Current projects in the electron physics section Faculty of Engineering, Osaka Prefecture University, Osaka, Japan. November 9, 1982.

294. Hobson, J.P. Current projects in the electron physics section of NRC. Faculty of Engineering, University of Hokkaido, Sapporo, Japan. October 29, 1982.

295. Hobson, J.P. Vacuum science - Foundation of surface studies. ULVAC Vacuum Company, Chigasaki, Japan. October 21, 1982.

296. Hobson, J.P. Vacuum science - Foundation of surface studies. Research Institute for Catalysis, University of Hokkaido, Sapporo, Japan. October 28, 1982.

297. Hobson, J.P. Vacuum science - Foundation of surface studies. Institute for Plasma Physics, University of Nagoya, Nagoya, Japan. November 5, 1982.

298. Hobson, J.P. Vacuum science - Foundation of surface studies. Vacuum Society of Japan, International Conference Centre, Kobe, Japan. November 12, 1982.

299. Hobson, J.P. Vacuum science - Foundation of surface studies. Short Course on Surface Analysis, University of Western Ontario, London, Ont. May 21, 1982.

300. Lipsett, F.R. New opportunities in space: research in microgravity. 2nd Canadian Conference on Astronautics, Ottawa, Ont. November 30 - December 1, 1982.

301. Lipsett, F.R. and Arnold, J.G. Research and applications on Canadian police patrol operations utilizing computers. Canadian Association of Police Chiefs Convention, Edmonton, Alta. August 24-28, 1981.

302. Moore, W.T., Frost, D.C., Hui, K.C., and Mitchell, K.A.R. LEED crystallographic studies for the adsorption of oxygen on the (0001) surface of zirconium. 65th Canadian Chemical Conference, Toronto, Ont. June 1, 1982.

303. Szabo, A. Laser spectroscopy of solids and optical memories. Physics Colloquium, University of Regina, Regina, Sask. March 9, 1982

304. Szabo, A. Quantum optics in solids. Physics Colloquium, University of Rochester, Rochester, NY. April 27, 1982.

305. Williams, B.R. Scattering of He from Cu(100) and Cu(110) with energy analysis. Cavendish Laboratory, University of Cambridge, U.K. July 2, 1982.

306. Williams, B.R. Scattering of He from Cu(100) and Cu(110) with energy analysis. Physical Chemistry Department, University of Cambridge, U.K. July 2, 1982.

307. Williams, B.R. Scattering of He from Cu(100) and Cu(110) with energy analysis. University of Genova, Geflva, Italy. June 21, 1982.

308. Williams, B.R. Scattering of light neutral atoms from surfaces. Physics Department, The University of Western Ontario, London, Ont. February 10, 1982.

309. Chapman, R. and Hobson, J.P. A solar operated magnetron pump-gauge. 29th Annual Symposium of the American Vacuum Society, Baltimore, MD. November 16, 1982.

310. Chrostowski, J., Delisle, C., and Tremblay, R. Acousto-optic bistable generator. Annual Meeting of Optical Society of American, Tuscon, AZ. October 19-22, 1982.

311. Delâge, A. Calcul des trajectoires de particules dans un champ électrique. Département de Physics, Université Laval, Québec (Qué.). Mai 1982.

312. Hobson, J.P. Modern surface analysis - an overview. Canadian Society of Spectroscopy Conference, St. Jovite, P.Q. September 29, 1982.

313. Hobson, J.P. Vacuum Science. Division of Chemistry, NRC, Ottawa, Ont. March 18, 1983.

314. Kornelsen, E.V., and Moore, T.W. Helium trapping in vacancies in a Mo(100) following bombardment by Mo^+ ions. Delft University of Technology, Delft, The Netherlands. September 27, 1982.

315. Kornelsen, E.V., and Moore, W.T. Vacancy production in Mo(100) by Mo^+ ions with energies 150 eV to keV. International Conference on Helium in Metal, Jülich, Germany. September 20-24, 1982.

316. Boulanger, P. et Delâge, A. Solution de problèmes d'optiques électronique sur des micro-ordinateurs. 51^e Congrès de l'ACFAS, Université du Québec, Trois-Rivières (Qué.). 25-27 mai 1983.

317. Delâge, A. La physique électronique, des premiers tubes électroniques à la microscopie électronique à balayage. École secondaire Louis Riel, Gloucester (Ont.). 27 avril 1983.

318. Dubé, D., Roy, D., et Delâge, A. Application de la méthode de sur-relaxation au problème du condensateur cylindrique, employé comme spectromètre électronique. 51^e Congrès de l'ACFAS, Trois-Rivières (Qué.). 25-27 mai 1983.

319. Hobson, J.P. Current projects in the Electron Physics Section of NRC. Institut für Grenzflächenforschung und Vakuum physik, Kernforschungsanlage, Jülich, West Germany. September 24, 1983.

320. Hobson, J.P. Limits of vacuum production and measurement. Philips Research Laboratories, Eindhoven, Holland. September 22, 1983.

321 Hobson, J.P. Limits of vacuum production and measurement. 9th International Vacuum Congress and 5th International Conference on Solid Surfaces, Madrid, Spain. September 29, 1983.

322. Hobson, J.P. The future of vacuum technology. 30th Annual Symposium America Vacuum Society, Boston, MA. November 1-4, 1983.

323. Hobson, J.P. Surface science in Japan. Surface Canada '83, University of British Columbia, Vancouver, B.C. June 23-25, 1983.

324. Lipsett, R.F. Science and music: illusions of the ear; auditoria; new instruments. The Chamber Music Conference and Composer's Forum of the East, Bennington, VT. August 8-12, 1983.

325. Lipsett, F.R. Science and music: illusions of the ear; auditoria; new instruments. NRC/DEE Science Association, Ottawa, Ont. March 16, 1983.

326. Szabo, A. and Chrostowski, J. Simulated on-axis photon, echo modulation in ruby. Fifth Rochester Conference on Coherence and Quantum Optics, Rochester, NY. June 13-15, 1983.

327. Szabo, A. and Chrostowski, J. Photon-echo modulation in ruby. Fouth International Conference on Dynamic Processes in the Excited State of Solids. Stanford University, Stanford, CA. July 11-14, 1983.

328. Armstrong, R.A. and Hobson, J.P. The contribution of ultrahigh vacuum science to catalysis. 9th Canadian Symposium on Catalysis, Quebec City, P.Q. October 1-3, 1984.

329. Chapman, R. and Hobson, J.P. Pumping of methane by a low power hot-cathode ion pump/gauge. 31st National Symposium American Vacuum Society, Reno, NV. December 4-7, 1984.

330. Delâge, A. Development of high brightness cathodes at NRC. Philips Research Laboratories, Eindhoven, The Netherlands. January 23, 1984.

331. Delâge, A. Nouvelle conception de cathodes en LaB_6 pour des applications nécessitant une grande brillance. Facultés Universitaires de Namur, Namur, Belgique. 17 janvier 1984.

332. Delâge, A. and Sewell, P.B. Study of space charge limitation of thermionic cathodes in triode guns. Third Pffefferkorn Conference, Ocean City, MD. April 9-14, 1984.

333. Fontaine, M. Diffusion dans la région anisotropique d'un cristal. Association canadienne-française pour l'avancement des sciences (ACFAS), Québec (Qué.). 9-11 mai 1984.

334. Fontaine, M. and Kornelsen, E.V. Diffusion in an anisotropic region of a crystal. Surface Canada '84, Montreal, P.Q. May 31, 1984.

335. Sewell, P.B. and Delâge, A. Thermionic emission studies of micro-flat single crystal LaB_6 cathodes. Third Pffefferkorn Conference, Ocean City, MD. April 9-14, 1984.

336. Szabo, A. Laser spectroscopy of solids and optical computers. Physics Colloquim, National Research Council, Ottawa, Ont. March 16, 1984.

337. Szabo, A. and Heber, J. Optically induced homogeneous line narrowing. International Conference on Quantum Electronics, Anaheim, CA. June 18-21, 1984.

338. Williams, B.R. Adsorption of atoms and molecules on different planes of copper and silver crystal using inelastic He scattering. Surface Canada '84, Montreal, P.Q. May 30 - June 1, 1984.

339. Delâge, A. and Sewell, P.B. Développement d'une cathode "microplan" de grande brillance. 53^{e} Congrès de l'ACFAS, Chicoutimi, P.Q. May 20-24, 1985.

340. Erickson, L.E. NMR measurement of rare earth ion in an excited state by indirect optical detection. Seventh International Conference on Laser Spectroscopy, Kanpaali, Hawaii. June 23-28, 1985.

341. Erickson, L.E. RF-Optical spectroscopy of rare-earth ions in insulating solids. Department of Physics, Queen's University, Kingston, Ont. March 20, 1985.

342. Hobson, J.P. and Chapman, R. The pumping of methane by St707 at low temperatures. 32nd Annual Symposium of the American Vacuum Society, Houston, TX. November 19, 1985.

343. Szabo, A. Laser memory systems. Canadian Association of Physicists Workshop on Modern Lasers and Applications, Toronto, Ont. May 6-9, 1985.

344. Szabo, A. and Chrostowski, J. On-axis photon echo modulator in ruby. Gordon Conference on Nonlinear Optics and Lasers, Wolfeboro, NH. July 28 - August 2, 1985.

PART 4: COURSES PRESENTED

1. Hobson, J.P. and Redhead, P.A. High Vacuum. A graduate course given at the University of Ottawa, January to April 1969. (2 hours per week, Electrical Engineering Department).

2. Hobson, J.P. Physique des surfaces. A graduate lecture course given in French as visiting professor at Laval University, Québec, January 17th to April 27th, 1972. (3 hours per week, Physics Department).

3. Redhead, P.A. Ultrahigh Vacuum and Surface Physics. A series of 21 different lectures given at the Bhabha Atomic Research Centre, Bombay and at various other Indian Institutions, January 17 to March 9, 1972.

4. Armstrong, R.A. "La physique des surfaces, PHY-60636", Université Laval, Québec (Qué.). October 12 - December 13, 1983.

PART 5: DIVISIONAL REPORTS

1. Redhead, P.A. The intensification of X-ray fluoroscopic images. October 1948. ERB 214.

2. Redhead, P.A. Graphical solution of the equation of motion of an ion in a time varying electric field. October 1950. ERB 188.

3. Redhead, P.A. and Lombardi, P. Investigation of the mode spectrum of a triple resonator magnetron anode. January 1951. ERB 251.

4. Redhead, P.A. and Armstrong, M.G. The Preparation of Thoria-on-Tungsten Cathodes. May 1951. ERB 252.

5. Redhead, P.A. A stabilized ion gauge control unit. January 1952. ERB 275.

6. McNarry, L.R. Bridge for Measuring the Interface Impedance of Oxide-coated Cathode. August 1952. ERA 213.

7. Redhead, P.A. and Crowell, C.R. Analysis of the linear r-f mass spectrometer. September 1952. ERB 293.

8. Redhead, P.A. A Stabilized D-C power Supply Variable from 0-25 Volts. November 1952. ERA 221.

9. Redhead, P.A. and McNarry, L.R. The Emission Life of Oxide Cathode Tubes. November 1952. ERA 229.

10. McNarry, L.R. A D-C Logarithmic Amplifier. March 1956. ERB 380.

11. McNarry, L.R. Development of a Miniature Mass Spectrometer of the Omegatron Type. July 1957. ERA 311.

12. Szabo, A. Electron transit times in space-charge limited plane diodes. June 1958. ERB-486.

13. Lipsett, F.R. Resolidification of cadmium in space. ERB-977. May 1985.

PART 6: PATENTS

1.	Ionization gauge	Canadian Patent No. 581,010, August 11, 1959. U.S. Patent No. 25, 369, April 16, 1963. (P.A. Redhead)
2.	Improved mass spectrometer	Canadian Patent No. 597,172, November 1, 1960. U.S. Patent No. 2,958, 774. (L.R. McNarry and J.P. Hobson)
3.	Ionization gauge for the measurement of low pressure	U.S. Patent No. 2,937,295, May 17, 1960. (P.A. Redhead)
4.	Desorption spectrometer	U.S. patent No. 3,068, 402, December 11, 1962. Canadian Patent No. 719-193, U.S. Patent No. 3, 174,325, 1962 (P.A. Redhead)
5.	Cold-cathode vacuum gauge	U.S. Patent No. 3,051,868, August 20, 1962. (P.A. Redhead)
6.	Vacuum pump and gauge	Canadian Patent No. 675,090, December 3, 1963. U.S. Patent No. 3,051,868, August 28, 1962, also patent in Germany (P.A. Redhead)
7.	Resolving power multiplier	Canadian Patent No. 708,283 and U.S. Patent No. 3,154,747, 1964. (B.R. Kendall)
8.	Ionization pump	Canadian Patent No. 709,950 and 709,951, 1965. U.S. Patent No. 3,1765,906 and 3,176,907, 1965. U.K. Patent No. 1,049,124. (P.A. Redhead)
9.	Improved orbitron	Canadian Patent No. 789,126 and U.S. Patent No. 3,339,106, 1967. Also Patent in U.K. (P.A. Redhead).
10.	Oxygen detector	Canadian Patent No. 810,304, April 8, 1969. (P.A. Redhead).
11.	Extractor gauge	Canadian Patent No. 316,282 and U.S. Patent No. 3,465,189, 1969. (P.A. Redhead)
12.	Hot-cathode	Patent applications pending in U.S., Canada, Germany and U.K., 1969. (P.A. Redhead)
13.	Thermal transpiration	Canadian Patent No. 259,172 and U.S., Canada, 3,565,551, February 23, 1971. (J.P. Hobson)
14.	Low pressure vacuum pump	U.S. Patent No. 3,565,551, February 23, 1971. Canadian Patent No. 897,127, April 4, 1972. (J.P. Hobson)

15.	Self-Q-Switching of ruby lasers	Canadian Patent No. 902,241, June 6, 1972. (A. Szabo and L.E. Erickson)
16.	Frequency selective optical Memory	Canadian Serial No. 108,587, March 24, 1971. U.S. Serial No. 217,893 filed January 14, 1972 (Pending) (A. Szabo)
17.	Vacuum gauge	U.S. Patent No. 3,884,080, May 20, 1975. Canadian Patent No. 988,739, May 11, 1976. (R. Chapman)
18.	Point scattering detector	U.S. Patent No. 4,179,609, December 18, 1979. (P.B. Sewell and K.N. Ramachandran)
19.	Apparatus for fast access to a series of stored images	U.S. Patent No. 4,432,071. Issued February 14, 1984. (A. Szabo)
20.	Fast input-output technique using Stark shifting for a frequency selective optical memory	Canadian Patent No. 1,197,009. Issued November 19, 1985. (A. Szabo)

The following patents were issued to company personnel while working with the Electron Physics Section under Incubator Agreements. As such they are formally the property of the Government of Canada.

21.	Magnetron sputtering apparatus	Canadian Patent No. 1,193,227. Issued September 10, 1985. (Ramachandran, K. and Giani, E., Epitek Electronics)
22.	SEM orbitron electron detector	U.S. and Canadian Patents Pending (Bouchard C., Boulanger, P., Black, R., Bausch & Lomb)

PART 7: STAFF SERVING ON OUTSIDE ORGANIZATIONS

Armstrong, R.A.

Liaison Officer, SEMCO IRAP. January 1977 to November 1978, SEM 243.

Secretary of NRC Patent Committtee, 1981-present

Liaison Officer for IRAP project on LaB_6, 1981.

Scientific Authority for PILP contract on updated scanning electron microscope, 1981.

Liaison Officer for IRAP Project on thick film microwave circuits with Anatek Microcircuits Inc. 1983-84.

Liaison Officer for NSERC. University-Industry Project on Semiconductor gas sensors with Simon Fraser University, 1984-present.

Delâge, A.

Liaison Officer for IRAP project on computerized chest radiography for Picker International, 1983-84.

Erickson, L.E.

Chairman of NRC Liquid Helium Committee. 1972 to present.

Hobson, J.P.

Member, Board of Editors, Journal Vacuum Science and Technology, 1964-1970. (6 year term)

Member, Program Committee, Annual Symposium of American Vacuum Society, 1968-1969.

Founding Chairman, Surface Science Division, American Vacuum Society, 1968-1970.

Member, Organizing Committee, 2nd International Symposium on Adsorption-Desorption Phenomena, Florence, Italy, April 1971.

Member, Program Committee, 5th International Vacuum Congress, Boston, U.S.A., 1971.

Membre du Comité des Publications, "Le Vide, les Couches Minces", Paris, 1973.

Trustee, Scholarship and Award Committee, American Vacuum Society, 1974-1976.

Chairman, Vacuum Study Group, Isabelle Summer Study, Brookhaven National Laboratory, U.S.A., 1975.

Hobson, J.P. (Cont'd) Member, Welch Scholarship Committee, International Union for Vacuum Science Techniques and Applications, 1975, 3 year term.

Secretary, Groupe d'études sur les matériaux (GEM), Montréal, Qué., Jan 1 - Sept. 1, 1977

Program Chairman, 6th Canadian Seminar on Surfaces, Kingston, Ont., June 6-7, 1977.

Canadian Representative for the 7th International Vacuum Congress and 3rd International Conference on Solid Surfaces, Vienna, Austria, Sept. 12-16, 1977.

Member, Board of Directors of the American Vacuum Society. 1978-1981.

Appointed Administrator of the Welch Foundation Scholarship for the International Union of Vacuum Science, Technique and Applications. 1980.

Member, Executive Committee of the Vacuum Technology Division, American Vacuum Society, 1980-1982.

Member, Founding Executive of the Joint Surface Science Division Canadian Association of Physicists and Canadian Institute of Chemistry, 1980.

Member, Scientific Program Committee, American Vacuum Society, 1981-1982.

NRC Laboratory member on Committee for Industrial Research Assistance (CIRA) 1981-85.

Appointed Associate Editor, Journal of Vacuum Science and Technology, 1981.

Fellowship, Japan Society for the Promotion of Science, Tokyo, Oct - Nov. 1982

Kornelsen, E.V. Member, International Committee on Atomic Collisions in Solids, 1971-1973.

Board of Editors, Journal Vacuum Science and Technology, 1970-1973.

Proceedings Editor, Journal of Vacuum Science and Technology, 5th International Vacuum Congress, 1971.

Member NRC Research Associates Committee. 1978 - present.

Kornelsen, E.V. (Cont'd)	Chairman, Gordon Conference on Ion-Solid Interactions, 1979
Landheer, D.	Liaison Officer on PILP Contract with Filtran Microcircuits, 1985 - present
Lipsett, F.R.	Advisor to operations Research Committee of the Canadian Association of Chiefs of police, 1975 - present
	Chairman NRC Committee on Micro-gravity. 1982
	Organizer of Symposium "Science & Music: Recording; New Instruments" for the American Association for the Advancement of Science, Detroit 1983
	Organizer of Symposium "Science & Music: Musician-Inventors" for the American Association for the Advancement of Science, New York, 1984
Pye, A.W. and Cottee, K.D.	Members of Program Committee. Annual Symposium of American Society of Scientific Glassblowers. June 27-30, 1972, Ottawa
Redhead, P.A.	Chairman, Technical Committee on Electron Tubes, Institute of Radio Engineers, 1955
	Member, Board of Editor, Vacuum, 1959-1970
	Member, Executive Committee of the International Organization for Vacuum Science and Technology, 1960
	Member, Editorial Board, Journal of Vacuum Science and Technology, 1964-1970 (6 year term)
	President-elect, American Vacuum Society, 1966
	President, American Vacuum Society, 1967
	Editor, Journal of Vacuum Science and Technology, 1970-1974
Sewell, P.B.	Scientific Liaison Officer on Bausch and Lomb Incubator Project, 1978 - 1985
	Member Organizing Committee for SEM Conference, 1980.
	Scientific Liaison Officer on Epitek Incubator Project, 1981 - 1985

Sewell, P.B. (Cont'd)	Scientific Liaison Officer on Pyrotenax Incubator Project, 1982 - present
	Scientific Liaison Officer on T.P.K. Incubator Project, 1982 - present
Szabo, A.	Technical Liaison officer, Project KDP022, IRAP
	Chairman, Sub-Committee on Laser-Radiation Hazards, Canadian Standards Association
	Member of Program Committee, VIIIth International Conference of Quantum Electronics, San Francisco, CA, June 10-13, 1974
	Member Program Committee for International quantum Electronics Conference, 1978 and 1982
	Member Canadian Standards Association, Laser Safety Committee, 1978
	IRAP liaison on dye laser development, 1981
	Member Program Committee, 5th International Conference on Laser Spectroscopy, 1981.
	Liaison Officer for IRAP project with Picker International on Computerized Chest Radiography, 1983-84
Williams, B.R.	Liaison Officer to Bell Northern, IRAP Project 006, Strain Sensitive Thin Film Devices, 1970-1972 (2 years).

PART 8: POSTDOCTORATE FELLOWS - RESEARCH ASSOCIATES

Kendall. B.R.F. — Term of Appointment February 1959 - February 1961. Ph.D. University of Western Australia. Joined staff of Nuclide Analysis Associates, University Park, Pennsylvania, U.S.A. after leaving N.R.C.

Khan, I.H. — Term of Appointment October 1959 - November 1961. Ph.D. Imperial College, London, England. Joined staff of National Aeronautics and Space Agency, U.S.A. after leaving N.R.C.

Robins, J.L. — Term of Appointment February 1961 - March 1963. Ph.D. Western Australia. Joined staff of Department of Engineering Physics and Materials Science, Cornell University, Ithaca, New York, U.S.A. after leaving N.R.C.

Ishikawa, K. — Term of Appointment August 1961 - February 1963. Ph.D. Tohoku University, Japan. Joined staff of Tohoku University, Sendai, Japan after leaving N.R.C.

Edmonds, T. — Term of Appointment August 1962 - October 1964. Ph.D. Bristol University, England. Joined staff BP Research Laboratories, Sunbury-on-Thames, Middlesex, England after leaving N.R.C.

Rigby, L.J. — Term of Appointment January 1963 - February 1965. Ph.D. Bristol University, England. Joined staff of Standard Telecommunications Ltd., Harlow, Essex, England after leaving N.R.C.

Sinha, M.K. — Term of Appointment September 1964 - August 1966. Ph.D. Pennsylvania State University, U.S.A. Joined staff of North Dakota State University, U.S.A. after leaving N.R.C.

Igarashi, T. — Term of Appointment October 1964 - August 1966. Ph.D. Tohoku University, Japan. Joined staff of Radio Research Laboratories, Tokyo after leaving N.R.C.

Edwards, D., Jr. — Term of Appointment February 1973 - December 1974. Ph.D. University of Illinois. Joined staff of Accelerator Department, Brookhaven National Laboratory, U.S.A. after leaving N.R.C.

Takeuchi, N. — Term of Appointment June 1973 - January 1974. Ph.D. University of Tokyo. Joined staff of National Institute for Environment, Ibaraki, Japan after leaving N.R.C.

Moore, S.E.	Term of Appointment September 1974 to 1979. Ph.D. University of Toronto. Joined Staff of INAX, Ottawa after leaving N.R.C.
Yamagishi, A.	Term of Appointment October 1975 - November 1976. Ph.D. University of Tohoku. Joined staff of Research Institute of Electrical Communications, University of Tohoku, Sendai, Japan after leaving N.R.C.
Egbert, W.C.	Term of Appointment June 1977 - September 1978. Ph.D. University of Wisconsin. Joined staff of University of Georgia after leaving N.R.C.
Van Gorkum, A.A.	Term of Appointment 1978-1980. Ph.D. University of Delft, Holland, 1980. Thesis based on work at NRC. Joined staff of Philips, Eindhoven, Holland, 1980 after leaving N.R.C.
Jessop, P.E.	Term of Appointment 1978-1981. Ph.D. Harvard University, 1978. Joined staff of McMaster University after leaving N.R.C.
Sau, R.	Term of Appointment 1979-1981. Ph.D. University of Rochester. Joined staff of India Steel Company after leaving N.R.C.
Sharma, K.K.	Term of Appointment August 1979 - March 1981. Ph.D. Carnegie Mellon Institute. Returned to Indian Institute of Technology Kanpur, India after leaving N.R.C.
Bomma Reddi, B.R.	Term of Appointment 1981-present. Ph.D. Indian Institute of Technology Kanpur, India. Joined staff of Memorial University, St. John's, Newfoundland after leaving NRC
Moore, W.T.	Term of Appointment 1981-present. Ph.D. University of British Columbia. Joined staff of NRC in Ottawa, Canada
Fontaine, M.	Term of Appointment Sept 1983 - Dec. 1985. Ph.D. Professeur subsititut, Université Laval, Québec. Jan.-mai 1986 après avoir quitté le CNRC.

PART 9: GUEST WORKERS

Domeij, B.	From Nobel Institute of Physics, Stockholm. Sweden. September 1963 - February 1964.
Stein, Prof. R.A.	From Electrical Engineering Department, Unversity of Alberta, Edmonton, Alberta. May 1964 - September 1964.
Inaba, Dr. H.	From Research Institute of Electrical Communications, Tohoku University, Sendai, Japan, july 1965 - August 1965.
Love, Dr. H.M.	From Department of Physics, Queen's University, Kingston, Ontario. June 1969 - August 1969.
Gopalaraman, G.P.	Under the India-Colombo Plan. January 6, 1969 - April 1970.
Leggett, Miss M.	From Department of Physics, Queen's Unversity, Kingston, Ontario. October 20, 1969 - February 1970.
Calcatelli, Mrs. A.	Under NATO Fellowship (Italian Fellowship) from Institu di Metrologia "G Colonette", Torino, Italy. January 27 - April 1, 1971.
Baker, Dr. B.G.	From Flinders University, South Australia. February 1971 - January 1972.
Murthy, Mr. M.S.	From Bhabha Atomic Research Centre, India, March 1973 - March 1974.
Muramoto, Dr. T.	From Shiga University, Otsu, Japan, November 1977 - October 1978.
van Gorkum, Mr. A.A.	From Delft University of Technology, Delft, The Netherlands, September 1977 - September 1978.
Caudano, Dr. R.	From Facultés universitaires de Namur, Belgique. January - August 1982.
Hontzeas, Dr. S.	From University of Regina. November 14, 1978 - January 15, 1979.
Heber, Dr. J.	Visiting Research Officer, Oct 1982 - Oct 1983 from Institut für Festkörperphysik der Technischen Hochschule, Darmstadt, Federal Republic of Germany.
Bouchard, C.	Ph.D. Laval University. With SEMCO/Bausch & Lomb/ Vickers Incubator Agreement, 1980 - 1985.

Ramachandran K.N.	Ph.D. University of Ottawa. With SEMCO/Bausch & Lomb Incubator Agreement 1973-1980. With Epitek Incubator Agreement, 1980-83.
Giani, E.	Ph.D. McMaster University, SEMCO/Bausch & Lomb Incubator Agreement 1978-80. With Epitek Incubator agreement 1980 - 1985.
Boulanger, Mr. P.	From Laval University. With Bausch & Lomb (Canada) Incubator Agreement. 1981 - 1985.
Black, Mr. R.	With Bausch & Lomb Incubator Agreement. 1982 - 1985.
Rodgers, Mr. J.	With Pyrotenax Incubator Agreement. 1982 - present.
Norman Dr. C.E.	With T.P.K. Incubator Agreement. 1982 - present.
Absi, Mr. E.	With T.P.K. Incubator Agreement. 1982 - present.
Tymoswski, Mr. G.	With Pyrotenax Incubator March 1984 - present.
Kosasih, Mr. V.	With Pyrotenax Incubator March 1984 - present.
Leung, Mr. Sai-Ming	With Epitek Incubator May 1983 - 1985.

PART 10: INTERACTIONS WITH CANADIAN INDUSTRY

After 1970, interactions between the Electron Physics Section and Canadian Industry increased and have resulted in the following agreements.

1. 1973 A 5-year cooperative research and development agreement with SEMCO Instruments Ltd. in conjunction with N.R.C.'s IRAP program (Industrial Research and Assistance Program) in the general area of scanning electron microscopes. Completed 1978.

2. 1977 A PILP (Participation Industry-Laboratory Program) contract with Raltech Inc. for the development of a Solid State Vacuum Gauge originating in the laboratory. Completed 1979.

3. 1977 A PILP contract with Canadian Vacuum Equipment Ltd. for the manufacture of an Ultra-high Vacuum Transfer Device whose prototype had been sucessfully built in the laboratory. Completed 1982.

4. 1978 In-house research as core support for the evacuated solar absorber of Canadian Sun System (later Spectravac). Completed 1984.

5. 1979 PILP contract with UHV Instruments Ltd., Burlington, Ontario, for magnetron pump-gauge in metal envelope. Completed 1983.

6. 1979 PILP contract for upgrading of Nanolab 9 scanning electron microscope, placed with SEMCO/Bausch & Lomb, Ottawa. Completed 1982.

7. 1979 Incubator project started with SEMCO/Bausch & Lomb, in the area of electron emitters of lanthanum hexaboride. Completed 1985.

8. 1979 Incubator project started with INAX Instruments, Ottawa, in the area of X-ray analysers if metal and metal-alloys. Terminated in 1981.

9. 1980 PILP contract with UHV Instruments Ltd., Burlington, Ontario, for automated vacuum transfer device and ultra-high vacuum suitcase. Completed 1983.

10. 1980 Incubator project started with Epitek, Ottawa, in the area of thin film production. Completed 1985.

11. 1982 Incubator project started with Pyrotenax, Trenton, Ontario in the area of parallel heating cable. Continuing.

12. 1982 Incubator project started with T.P.K. Solar Systems Inc. in the area of solar cells. Continuing.

PART 11: LIQUID HELIUM

In 1960, the Electron Physics Section undertook the responsibility of supplying liquid helium to the Ottawa area, in particular to all divisions of N.R.C. as well as to local universities and industries. Occasionally, deliveries were made outside the Ottawa area. Deliveries have risen from 1,700 litres of liquid in 1960 to some 40,000 litres of liquid annually in 1985.

PART 12: PRESENT STAFF, OCTOBER 1985

Professional

Dr. R.A. Armstrong	Senior Research Officer
Dr. A. Delâge	Associate Research Officer
Dr. L.E. Erickson	Senior Research Officer
Dr. J.P. Hobson	Assistant Director
Dr. E.V. Kornelsen	Senior Research Officer
Dr. D. Landheer	Associate Research Officer
Dr. F.R. Lipsett	Senior Research Officer
Dr. W.T. Moore	Assistant Research Officer
Dr. P.B. Sewell	Senior Research Officer
Dr. A. Szabo	Senior Research Officer
Dr. B.R. Williams	Senior Research Officer

Technical

D.L. Blair	Technical Officer 8 (Electronics)
R. Chapman	Technical Officer 10 (Electronics)
R. Côté	Development Officer 3 (Mechanics)
J. Froemel	Technical Officer 8 (Electronics)
R. LeBreton	Technical Officer 7 (Liquid Helium)
J. LeGeyt	Technical Officer 8 (All-purpose)
B.F. Mason	Technical Officer 7 (Experimental Assistant)
R.W. Stewart	Technical Officer 8 (All-purpose)
E.A. Vilks	Technical Officer 7 (All-purpose)

Secretary

Mrs. S. Routliff	Secretary 3